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MECHANICAL ENGINEER

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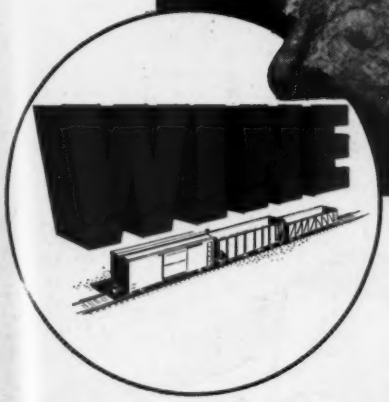
The unretouched photograph illustrates a proven example of the actual durability and strengthening effect of *every* Wine CAST STEEL Hopper Frame. Engineered design from the very beginning has prevented distortion in the adjacent car parts. In twenty years of service, these hopper frames have insured lading against loss due to leakage around the hopper opening.



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HOPPER FRAME

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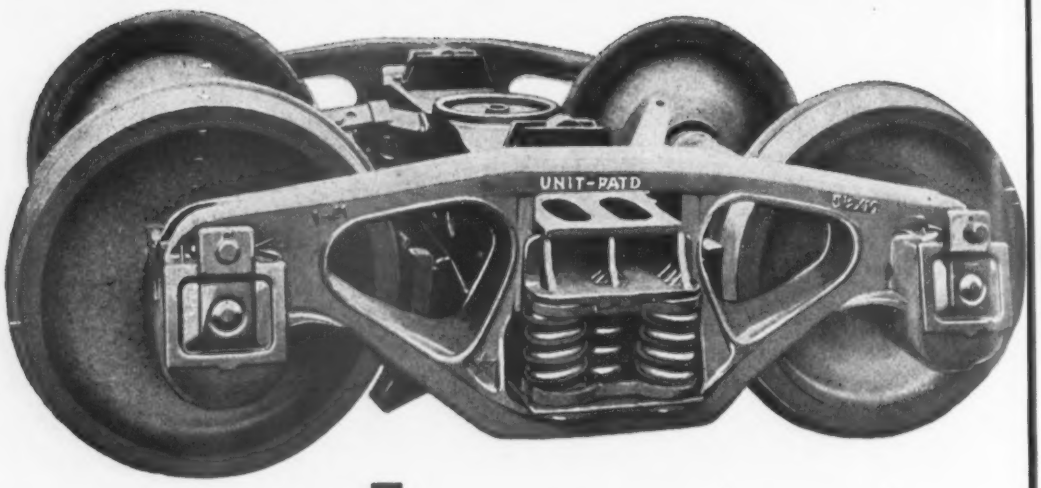
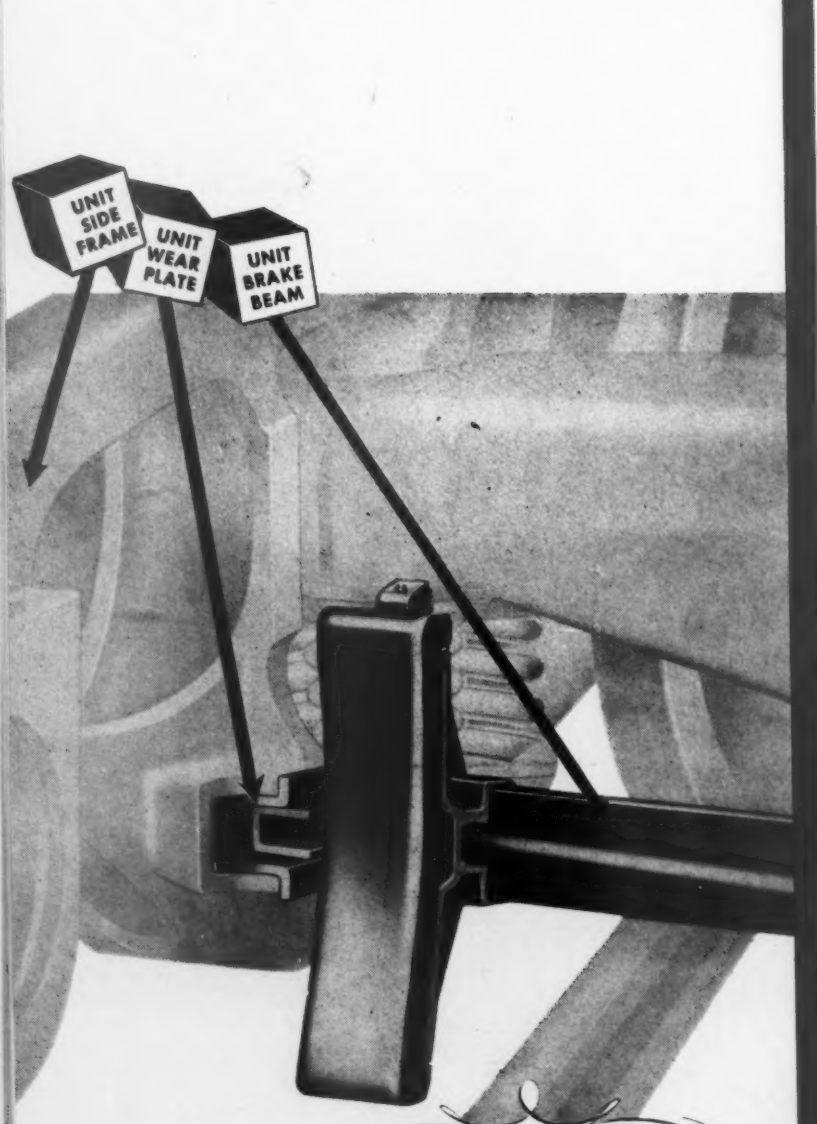
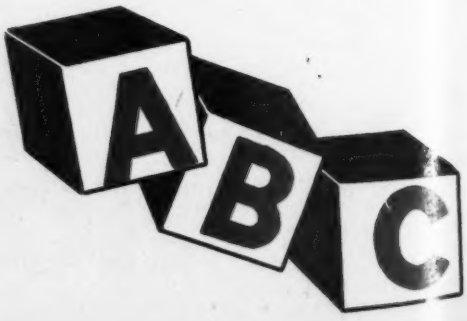


UNIT TRUCK IS SIMPLE AS



THAT'S ALL THERE IS TO A UNIT TRUCK—no hangers—no hanger pins—no cotters—no safety supports—no other supplementary devices to maintain.



JUNE, 1949

RAILWAY MECHANICAL ENGINEER

With which is incorporated the Railway Electrical Engineer. Founded in 1832 as the American Rail-Road Journal.

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These illustrations show a CINCINNATI FILMATIC No. 3 Centerless set up for grinding frame bolts by the infeed method. The complete length of the bolt under the head is ground to size in one operation.

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Operating Procedure At C. & N. W. Diesel Shop

Careful study of material handling throughout Diesel repair area makes appropriate the title "Shop on Wheels"

ONE of the best examples of modern Diesel shop construction is located on the Chicago & North Western at Chicago. The principal Diesel building is 142 ft. by 407 ft. with three through tracks for running maintenance* and one track for heavy repair work which is open at one end only. The building can handle either 16 freight units or 12 passenger units at one time.

The total number of locomotive units assigned to this shop for the various classes of maintenance include 43 passenger units for servicing and heavy repairs, 10 passenger units for servicing only, 15 freight units for servicing and heavy repairs and all truck work on 47 additional freight units. The truck work on 45 new freight units to be acquired later this year will also be assigned to the Diesel shop at this point. Fifteen Diesel switchers are also serviced in the new Diesel shop, but most heavy repairs are made to them in the adjacent steam erecting shop.

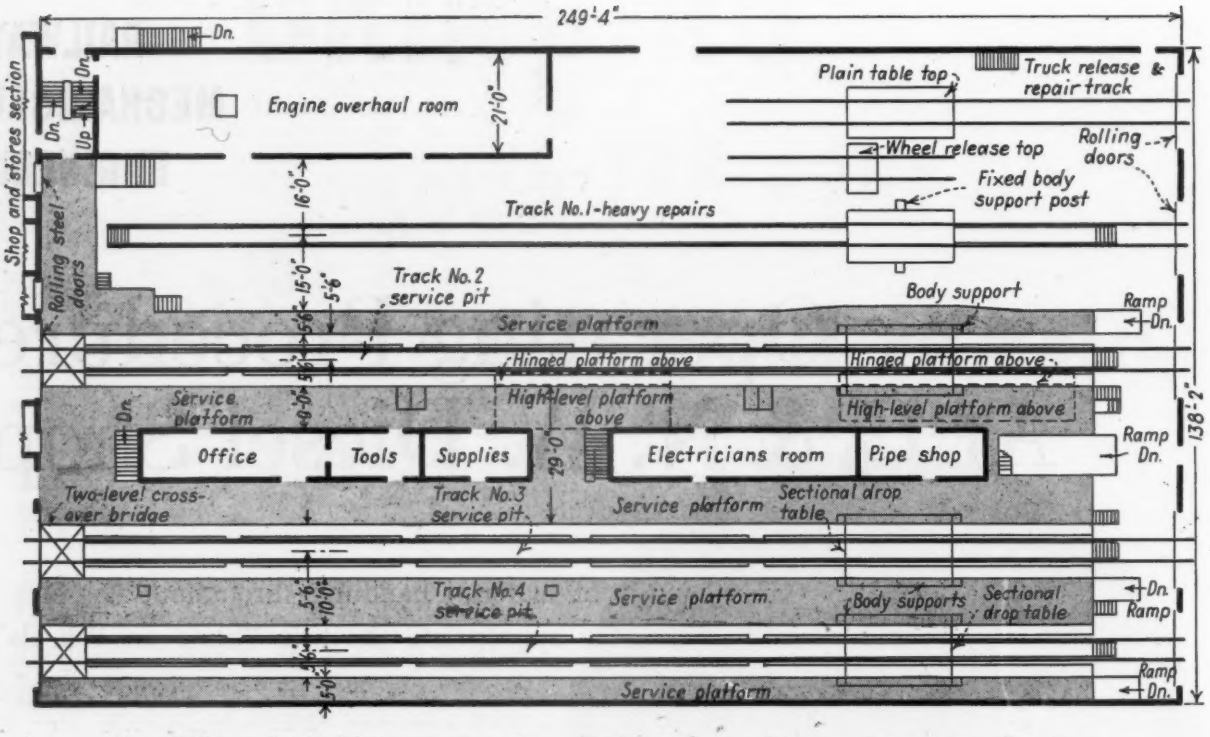
The shop can, therefore, be best described in general as a system shop for road freight and passenger locomotives, and as a divisional shop for switching power. The shop can also be described partially as a heavy repair shop and partially as an assembly shop. Repairs which require the use of heavy machinery, such as machining cylinder liners, boring out main generator housings for armature bearings, all traction motor rewinding jobs, cam shaft grinding, etc., are performed in the steam locomotive machine shop. Body repair work is done in the erecting shop, truck work in the Diesel building. There is also an existing structure immediately west of the new Diesel building which is used for any overflow of Diesel locomotives requiring heavy repairs on which a crane is not a particular advantage.

* The term "running maintenance" as used in this article means routine servicing plus progressive maintenance work as due.

Layout of the Building

The exterior of the building is of brick, with glass block panels used extensively to supplement the electric lighting; these panels contain flights of

Looking west along the heavy repair track showing the drop platform in the center, the engine overhaul room in the right background, the top of which is used for spare engine storage, and in the far background the 30-ton overhead crane which spans the heavy repair track and servicing track No. 3



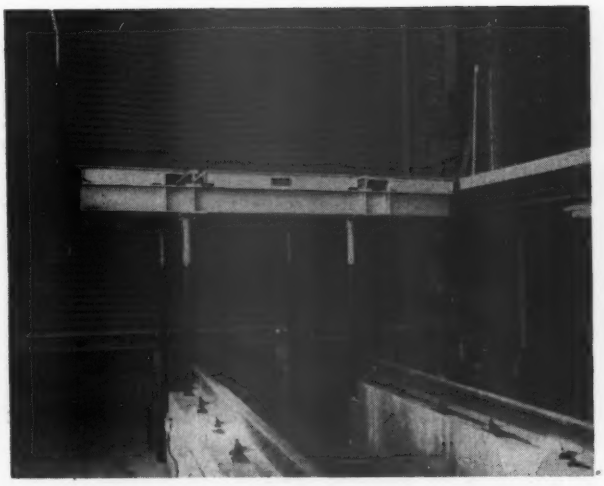
Plan of the service and heavy repair section—Shaded areas are platforms at locomotive floor level

Below: Looking west along service track No. 3 with No. 4 at the left showing the continuous-depth pit through the drop table in the middle foreground, the row of offices and sub shops on the platform at the right, and the effect of the cantilever design for the servicing platforms in reducing obstructions along the lower depressed level

windows for ventilation. Altogether the shop has some 14,000 sq. ft. of glass block and 3,500 sq. ft. of steel sash windows.

This shop has two principal components. One, the service and heavy repair section, is 140 ft. wide and 250 ft. long, with the latter dimension extending in an east-west direction. Adjoining this main portion of the structure at its west end is a section 49 ft. by 155 ft. which houses some of the auxiliary shops and affords space for the stores department.

The service and heavy repair section is divided longitudinally into a low bay, containing two service tracks, and a high bay, containing one combination servicing and repair track and a stub-end track for heavy repairs. The two service tracks and the combination track extend entirely through the building and have full-length inspection pits. They are served by depressed and locomotive-floor-level working areas, and, in addition, the combination track in the high bay has a partial-length working platform at the roof level. This platform has a hinged section which, when lowered to the horizontal position, permits workmen to walk directly onto the roofs of locomotives.



Drop ramps of the type shown above are used at the west end of each of the three servicing tracks to permit continuous passage between the servicing platforms—When a locomotive is to be moved out the west end of the shop the ramp is lowered by push-button control to form a continuous rail

Platforms of Cantilever Design

The locomotive floor-level platforms are concrete and constructed to a cantilever design, with the edges overhanging the supporting columns as much as 7 ft. 6 in. to afford a maximum of unobstructed working area alongside the tracks at the depressed floor level. The edges of all service platforms adjacent to tracks are protected by hand railings of removable pipe posts connected with detachable metal chains. Outlets for steam, water, compressed air and electricity are located at convenient points along the edges of the service platforms. The service platform at locomotive-floor-level between tracks 2 and 3 has a width of 29 ft., and on this platform is a row of enclosed rooms, providing space for an office, a tool room, a supply room, an electrician's room, and a pipe shop. Under this platform, at the depressed level, are other rooms for similar uses.

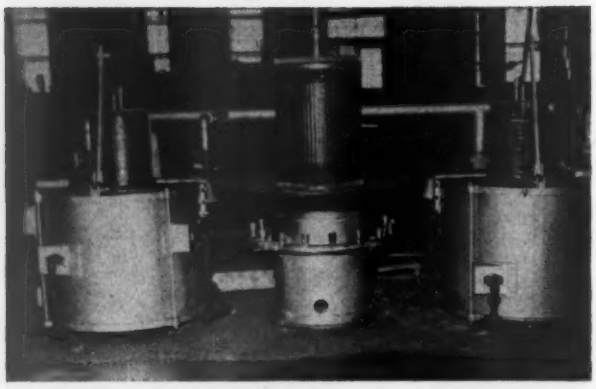
To permit workmen to pass freely to and from the engine pits, openings in the walls of the pits are provided at convenient intervals.

At the west end of the main building is a Whiting two-level crossover bridge at the location of each of the through tracks. Each of these bridges consists of a platform, incorporating a short length of track, which is raised and lowered from below by four motor-driven vertical shafts actuated by a motor. Normally these bridges are in the raised position, level with the service platforms at locomotive-floor height, for free movement at that level for workmen and trucking vehicles. When the bridges are in this position there is also complete freedom of movement in the transverse direction at the depressed level. To move a locomotive into or out of the building at the west end, the crossover bridge on the particular track is lowered until the rails on the platform coincide with the pit rails, in which position the bridge is supported on steel bearing shoes. Bridge movements are controlled by push buttons and limit switches.

The doors for the entry and exit of locomotives

Four principal types of hand trucks used in the Diesel shop are shown above—On the left is the truck for carrying a complete assembly of liner, head, rod and gaskets to the locomotive; next to it is a cart for moving groups of lube oil filters; on the center right is a truck for moving rods, pistons, flat-type air filters and miscellaneous small parts; on the right is a cart for carrying pistons

are of the steel overhead rolling type, motor driven and push-button controlled, 16 ft. wide and 17 ft. high. Exhaust fumes from locomotives spotted in the lower bay are confined in overhead pockets and exhausted by power-driven roof ventilators. General lighting in this section is fluorescent, including longitudinal rows of fixtures overhead as well as underneath the locomotive floor level platform. Heating in the above area, as well as in most other parts of the shop, is of the radiant type embodping coils embedded in the concrete floor. It is supplemented where necessary by unit heaters. Radiant heating is also used under all the concrete runways at the outdoor fueling facilities at the east end of the shop for melting snow and ice to permit all-weather operation of shop trucks in this area.



Arrangement for soldering risers in two minutes—Pure tin is melted in the two drums and caused to flow to the dish-shaped member between the drums —The armature rests lightly on an asbestos-covered steel ring with the main portion of the load taken by the crane during the soldering operation

For delivering fresh lubricating oil to locomotives, Bowser hose-reel and meter units are spaced at intervals on the service platforms. Used lubricant is drained off by gravity and delivered to sumps at the outer end of an extension to the building between tracks at the west end. There two sumps for this purpose so that one may be cleaned while the other is in use. A 50-gal.-per-min. pump delivers oil from the sumps to portable tanks, in which it is taken to an existing oil reclamation plant in the shop area.

The extension at the west end houses a storage room for special oils and greases at the level of the service platforms, and a battery room at the depressed level. This extension is served by an outside unloading platform, with concrete ramps connecting with the ground level and thence with the depressed level. For melting snow and ice the unloading platform and the ramps have radiant heating systems.

The Drop-Table Hoist

All tracks in the shop are served by a Whiting 100-ton drop-table hoist with a pit 23½ ft. wide and 135½ ft. long to serve all four shop tracks. The table tops have depressed floors 4 ft. deep between the rails and 2 ft. 6 in. deep outside, so that the pits are continuous through them. All the table tops at the service tracks are sectional to permit either a complete truck or a single pair of wheels to be dropped, as desired. At the truck-release point in the heavy-repair area the opening to the drop-table pit is covered with a platform flush with the surrounding floor which is designed to raise automatically when a truck is being raised for release by the drop-table hoist. When the hoist is lowered the platform returns to its normal position, providing a continuous unobstructed floor area over which workmen may move at will. The drop-table hoist is operated by a push-button control, and three indicator boards are provided at different locations, on each of which colored lights reveal the exact location of the hoist at any given time.

The drop-table pit has a subterranean area built into the side walls of the pit. After truck repairs are made, the trucks are stored in this area and held until needed. Immediately outside the shop at the east end, adjacent to the truck release and repair track is a large lye vat served by a 10-ton traveling crane.

Spanning the width of the high bay (74 ft. 9 in.), and operating on runways extending its entire length of 250 ft., is a Whiting 30-ton crane with a 5-ton auxiliary hoist. The crane has an operator's cab with optional operation from the floor by pendant push-button control.

The overhauling of engines is done in a completely enclosed room in a corner of the high bay. The concrete roof of this room is designed to carry a load of 500 lb. per sq. ft., so that it may be used as storage space for spare engines, generators and other heavy parts. Facilities inside the engine overhaul room include a 5-ton Harnischfeger overhead crane, with pendant push-button control, which operates on runways extending the full length of the room.

Fuel and Sand Facilities

The outdoor fueling station at the east end of the shop has facilities for metering and delivering fuel oil simultaneously to three coupled units on any one of the five tracks. An overhead sand storage tank also located at this point has a hose on the track side to sand Diesel switchers and one on the platform side for delivering sand to a portable sand plant. This unit consists of a standard Yale high-lift truck on which is mounted a vertical cylindrical sand-storage tank having a capacity of about 40 cu. ft. It has a cone-shaped bottom fitted with a sand-delivery hose. To sand a locomotive the storage tank is raised to the elevated position, permitting delivery of sand by gravity flow.

For the rapid transmission of instructions a communication system will be installed in the shop, with the control station located in the foremen's office. The system will incorporate paging speakers and talk-back stations at various points inside the building and in the immediate vicinity outside. For fire protection there is a variety of equipment, including fog throwers, hose reels with conventional nozzles, and hand fire extinguishers.

The shops and stores section of the new building has three levels, the lower of which, a half basement, is connected by a ramp with the depressed level in the service section of the main building. This lower level is devoted entirely to the storage of repair parts. The main floor of the shop and stores section is at the same elevation as the locomotive-floor-level working areas in the main structure. It contains office space for the stores personnel, a store room, a room for cleaning filters and parts, a parts reconditioning room, and a sound-proofed room, provided with filtered air, for overhauling precision parts, such as injectors and governors. Connecting doors between the shops and stores section and the service and heavy repair section are fitted with overhead steel rolling fire doors.

Equipment in the parts reconditioning room includes three overhead crane systems, each having two

1,000-lb. hoists. In the filter and parts cleaning room there is a two-ton overhead crane. Other equipment in this room includes a filter cleaner, a filter oiler with a motor-driven chain hoist overhead, and two dip tanks with a drain area in between.

The entire third floor of the shops and stores section is devoted to facilities for employees, including a locker and wash room, a lunch room, and separate rooms for toilets and showers.

Fuel and lubricants are furnished from storage and pumping facilities located several hundred feet north of the shop building. These include a 150,000-gal. fuel-oil storage tank and an oil unloading rack with capacity for five cars at a time. The oil is pumped from the storage tanks to the delivery outlets by two 200-gal.-per-min. pumps arranged in parallel. A brick building houses these pumps, together with filters, a pressure tank and pumps for lubricating oil.

Procedure Through Terminal

All passenger Diesel locomotives are serviced inside the Diesel servicing building with the exception of three "City" trains (Los Angeles, Portland and Denver). Locomotives for these three trains are serviced on what is known as the "streamliner" ramp which has been in service for a number of years. It has six tracks with 4-ft. pits and a fueling pipe on every other track, so that a locomotive can be fueled on any of the six tracks. Normal trip maintenance only is performed here; if any defects are found the locomotive is brought into the Diesel shop after receiving fuel and water.

Other Diesel-electric passenger locomotives are fueled at the outside station on the east end of the shop and enter the shop at the east end heading west. Locomotives that pull the "400" and other streamliners proceed out of the shop on the west end to pick up their train at the streamliner ramp. Locomotives for conventioal trains leave by the east end of the shop to pick up their trains at the California Avenue coach yards two miles east.

For routine running maintenance a locomotive enters on any one of the three servicing tracks. When heavy repair work is required or anticipated, Track 2 is used because it is serviced by the 30-ton overhead crane. For any work which will take longer than normal running maintenance time, Track 1, the heavy repair track, is used. Normal running maintenance time is considered at about five hours for a 1,000-mile run up to 8 hours for 3,000-mile run. Where locomotives are assigned to runs shorter than 1,000 miles, several are accumulated before the locomotive is brought into the shop.

Road freight locomotives and switching locomotives generally arrive at night when there is usually sufficient room for them in the Diesel building and they are given running maintenance or servicing therein. The switching locomotives are given heavy repairs in the back shop on the basis of hours of switching work performed; progressive maintenance is not used as it is on the freight and passenger locomotives.

The assignments of men of the various crafts in the Diesel shop building are divided into four groups.

1—A cleaning and servicing group under an assistant foreman and consisting of machinist helpers, electrician helpers, carmen and laborers.

2—A running maintenance gang with three foremen, each foreman having a balanced gang of machinists, electricians, sheet metal workers, etc.

3—An inspection force with one foreman for main bearing inspection, I. C. C. inspection, piston changes, and parts reconditioning for small assemblies.

4—A force under one foreman for engine rebuilding, engine and generator changes, and truck changes.

Added flexibility is given this arrangement by permitting the running maintenance group to borrow as necessary from the inspection force to handle peak demands.

A list of the principal machines installed in the Diesel building is shown in Table I. Those installed in the steam shops which are used for Diesel repair work are listed in Table II. In addition to these machines numerous jigs and fixtures have been designed by the workers to facilitate Diesel work.

The parts-reconditioning room sends overhauled subassemblies of head, liner, piston, connecting rod and gasket to the engine-overhaul room on four-wheel racks—They are stored covered with a tarpaulin in the engine-overhaul room until ready for application

The engine-overhaul room from the west end—The steel door in the background opens to admit and exit the engines

TABLE 1—PARTIAL LIST OF MACHINERY IN THE DIESEL SHOP

One filter-washing machine
One Magnaglow machine
One Zyglo machine
One 50-ton hand-operated hydraulic press
One injector testing machine
One speed recorder tester
One engine governor tester
One 10-in. lathe
One valve grinder
Three small ½-hp. pedestal grinders
One 7½-hp. heavy duty grinder
Two ¼-in. Delta drill presses
One Cincinnati 24-in. upright drill press
Two ½-hp. portable buffing machines
One small portable pipe cutter, ½-hp., capacity 2-in. pipe
Two battery charging sets
Two drying and de-icing units
One General Electric load tester for engines up to 2,000 hp.
One 300-amp. welder
Two tractor-type industrial trucks
One 2-ton lift truck equipped with a seat to allow the operator to pass under the working platforms
One sanding truck
One 1-ton portable hand-operated hydraulic crane
Numerous portable power tools, such as torque wrenches, micrometers, tachometers, etc., are kept in the toolroom
Numerous jigs and fixtures built by the railroad

TABLE 11—MACHINE TOOLS IN THE STEAM LOCOMOTIVE SHOP EITHER BEING USED OR CONTEMPLATED FOR FUTURE USE ON DIESEL LOCOMOTIVE WORK

Davis & Thompson Rotomatic for boring out cylinder liners and traction motor housings
Giddings & Lewis No. 350 T horizontal boring mill
Lodge & Shipley 27-in. by 10-ft. lathe for miscellaneous heavy work
Landis 20-in. by 10-ft. grinder for traction motor shafts and other shafts as needed
24-in. Bullard vertical turret lathe for miscellaneous small work
Milwaukee No. 5 vertical milling machine for use in conjunction with a circular table for milling out cylinder head tops and keyways not done on the vertical turret lathe
Cincinnati No. 4 milling machine for making the serations on bearing caps and for possible future use on milling cam shafts
Milwaukee No. 5 H milling machine also used for bearing cap serations
Monarch 22½-in. by 96-in. lathe for traction motor and generator shafts
Gisholt model 1 L turret lathe for stub shafts
Bullard 54-in. high-bed Cut-Master to bore out main generator casings for armature bearings
Bullard 54-in. standard vertical turret lathe for reboring boxes and for refacing Baldwin and Alco heads
Bullard 36-in. standard vertical turret lathe for connecting rod work
10-in. by 36-in. Cincinnati Universal cylindrical grinder for jack, pump and stub shaft work up to and including cam shaft size
Heli-arc welding equipment for aluminium pistons
Metallizing equipment to build up steam generator pump piston rods

Of particular interest among those devices built by the railroad for use in the Diesel shop are a series of four-wheeled hand carts of various sizes and uses. These carts have two fixed and two swivel wheels for easy maneuvering any place in the shop. One of the largest carts is for transporting an assembly of a piston liner, head, piston, connecting rod and the necessary gaskets, with the piston-and-rod assembly resting in a box-shaped enclosure. This cart is wheeled directly to the locomotive and the assembly applied. At the same time the replaced parts are loaded onto the cart and carried thereon to the parts reconditioning room for repair.

A second type of cart with a wooden flooring is used to carry heads, pistons, rods and other medium sized parts between various points in the parts-replacement room and between this room and the cleaning room adjacent to it. The remaining carts are used for miscellaneous service on small parts.

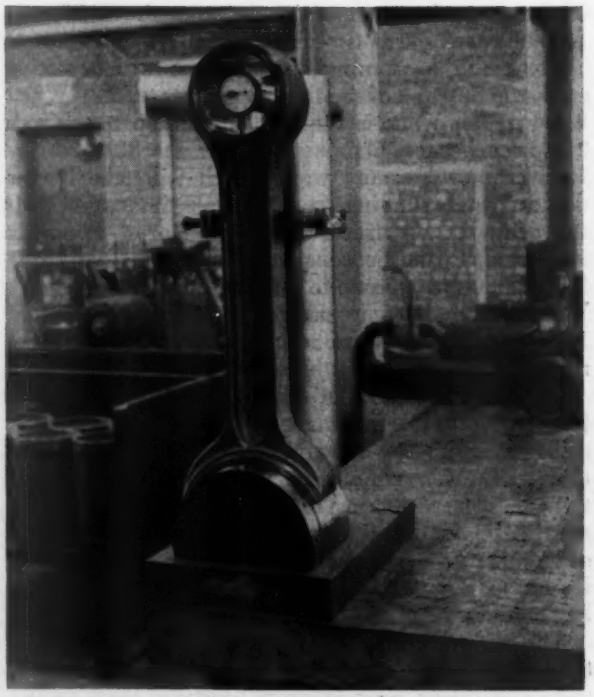
Diesel Engine Overhaul

The engine overhaul room incorporated along the west end of the north side of the heavy repair track for overhauling Diesel engines and auxiliaries is supplied with filtered air to eliminate dust and foreign particles. The engines are brought into this room from the east end through an opening which is closed off by an electrically operated overhead steel door. The room is used at the present time for overhauling Electro-Motive Model 567 and 567A engines, Alco, Baldwin and Fairbanks-Morse engines that require overhaul are sent to a portion of the steam erecting shop devoted to heavy Diesel work.

When engine removal is necessary the locomotive is placed on the heavy repair track in the Diesel building and the engine removed by the 30-ton overhead crane after disconnecting the main generator. The engine is then completely stripped, and the engine plus the removed parts and auxiliaries are cleaned in an outside vat at the east end of the shop. The 567 and 567A engines are put on four four-wheel dollies, one at each corner, and wheeled into the overhaul room. Other engines are loaded on a shop flat car and sent to the erecting shop for overhaul.

The engine overhaul room proper is primarily an assembly room. The parts used in rebuilding the engine are either obtained new from manufacturers or are reconditioned elsewhere in the shop. Such parts as pistons, liners, heads, injectors and governors are sent to the parts-reconditioning room where they are either reconditioned or farmed out for repair, e.g., liners requiring machining are sent to the steam locomotive machine shop. The parts-replacement room returns the repaired parts to the overhaul room ready for assembly, and, in some cases, in pre-assembled sub-assemblies. An example of the latter is the Diesel head, liner, piston, connecting rod and gasket which is pre-assembled in

Connecting rods are checked for twist with a dial gauge



the parts-replacement room. The assemblies are then loaded four at a time on a four-wheel rack for return to the overhaul room and stored there. Overhaul room work includes checking and parts replacement on blowers, pumps and harmonic balancers. The overhaul room forces also checks crankcases for alignment and out-of-roundness.

Parts Reconditioning Room

The parts-reconditioning room actually encompasses three separate adjacent enclosures. One enclosure is for cleaning filters, pistons, heads, cylinders and liners. The second tests governors, injectors, speed recorders and some pilot valves; repairs made to these are on a parts-replacement basis. The third room handles valve grinding, pressing out liners, checking connecting rods, repair work on heads up to but not including welding, Magnaflux and Zyglo tests, and miscellaneous light repairs to engine parts. Any heavy repairs to engine equipment, such as boring liners, which is found to be necessary by the reconditioning room is sent to the steam machine shop for the heavy work.

Carbon is successfully removed from the injector nozzle tube by boiling in a small metal container filled with Oakite and water to a depth at which the boiling action causes the mixture to spew through the opening. Optical flats have been purchased to check injector spacers and check valves for flat surfaces.

Any major locomotive body repairs that become necessary are assigned to the Diesel portion of the steam erecting shop. All steam generator work, including the checking of the mechanical and electrical controls, are performed on the locomotive. Air brake equipment is reconditioned in an existing room in the steam back shop. Repairs to passenger, freight and switching locomotive trucks which have been removed from the locomotive are made in the Diesel building. A trestle with two rails supported about 3 ft. above the floor is incorporated in the northeast corner of the Diesel building for assembling four- and six-wheel trucks. An equalizing sling is used to handle assembled trucks on and off the trestle.

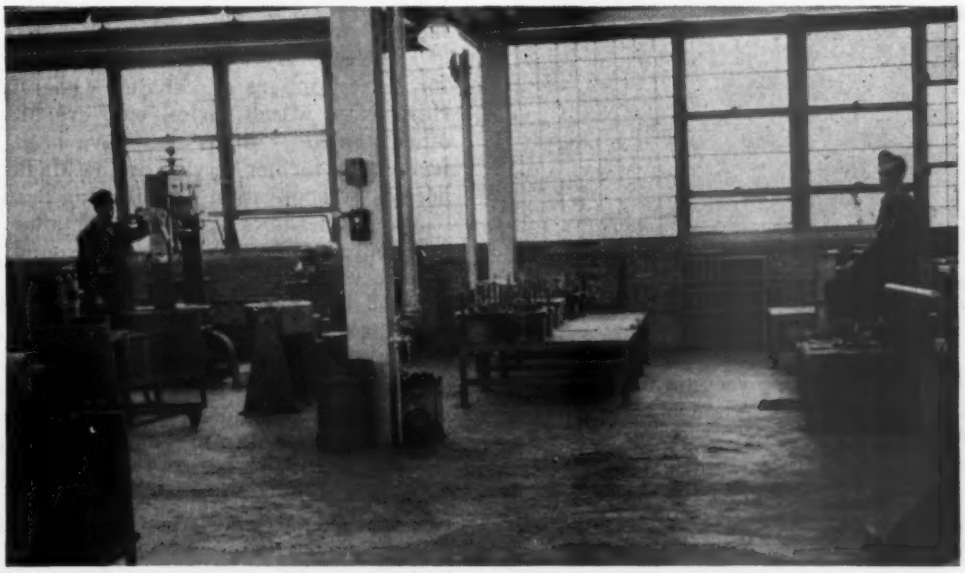
Repairs to Electrical Equipment

The repairs given to electrical equipment are performed in a section of the steam locomotive shop served by a 7-ton walking crane and can be roughly divided into two classes. Motors and generators are overhauled completely, including armature rewinding, vacuum impregnating, balancing and baking. Repairs to control equipment generally consist of inspection, parts replacement, and rebuilding to standard.

Traction motors are removed when truck work is required, wheels changed or when a unit is in the shop for repairs. If the mileage on the traction motor is less than 250,000, it is tested with a megger and given a dielectric test of 1,000 volts after cleaning. If it is found satisfactory the motor is not taken apart.

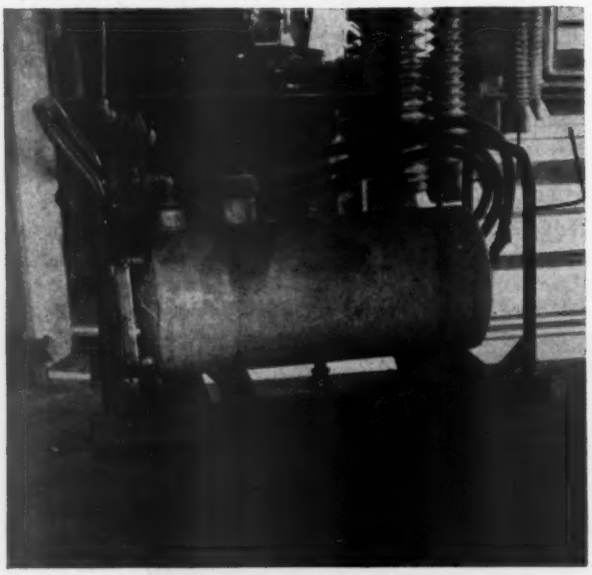
When the mileage is 250,000 or more the motor is stripped completely and processed. In processing, the armature is removed and cleaned, tested for grounds, loose commutator bars, loose wedges in the armature core, loose armature bands and partial open coils in the armature. Processing further includes a single vacuum impregnation, baking for 24 hours, turning to check shaft alignment, balancing to within three grams on a Gisholt Dynetric balancing machine, ground testing with 1,500 volts, and re-installing with new roller or ball bearings.

When rewinding is required, the armatures are



The center section of the main room for parts reconditioning

stripped, the cores cleaned out, a check made for loose bars, and the commutators cleaned up. New coils are applied, heated and banded temporarily. The back connections of split-type armature coils are silver soldered in a machine in which the heat is obtained by a heavy low-voltage current in a head designed specifically for armature coil soldering. After the coils have been silver soldered and the insulation applied, the temporary banding is removed and a double permanent band put on. The armature is



Portable conveyance for filling traction motor housings with oil

then heated in an oven, double vacuum impregnated, baked for 24 hours, the shaft alignment checked, a 2,300-volt ground test given, the armature dynamically balanced and ball bearings applied.

While the armature is being repaired on one side of the aisle the frame is being conditioned on the opposite side. Normally, the frame work required is to wash with solvents, repaint coils and frame, repair brush holders, renew motor leads, check connections, test and assemble the bearings. The housing is set on end on top of a ring to make it level for the application of the armature. After the armature is applied, the assembly is placed on the floor to see that it runs properly with respect to noise, smoothness and bearing temperature. Before being released for application to the truck, the motor is given a final check on a transportation tester.

Soldering Procedure

Riser connections are soldered in a specially designed soldering pot in a few minutes as compared to the eight or more hours it would require by hand. This special pot arrangement allows pure tin to be heated in two tanks, one on each side of a dish-shaped member with a hole in the center for the commutator to rest in. The armature is lowered into place on a ring wrapped in asbestos. A large piston is lowered by hand into each of the melting tanks, forcing the molten tin to flow into the dish and around the risers. The risers remain immersed in the tin for about two minutes to permit complete soldering of the connections. While molten, the tin is prevented from leaking through the center opening by the asbestos-covered gasket.

The electrical shop has its own Magnaflux machine for testing pinions and shafts. Other parts, such as ring gears, wheels, axles, etc., are Magnafluxed at other points. Pinions that have been found satisfactory for further service by the Magnaflux test are heated for application by induction heating.

Main generators are processed after 1½ million miles of service; they are rewound only when necessary.

Oscillating headlights and other electrical jobs are done in this electrical shop. The majority of the remaining work, such as any rewiring of electrical cabinets, and the testing and parts replacement for most control equipment is done on the locomotive.

The automatic train control equipment for 75 Diesel units and 350 steam locomotives is overhauled in the electrical shop annually. All amplifiers and primary relays used in automatic train control are overhauled, repaired, and tested in a special built air-conditioned dust-proof room located in the electrical shop.

Heavy electrical work is performed in a section of the nearby steam locomotive back shop—On the left of the aisle motor and generator frames are cleaned and armatures vacuum impregnated—On the right armature repairs are made—The 7-ton walking crane which serves the heavy electrical repair shop can be seen in the background

Some Modern Trends in Passenger Car Repair Shops

A general review of some recently built or modernized shops showing some features of each and what they have in common

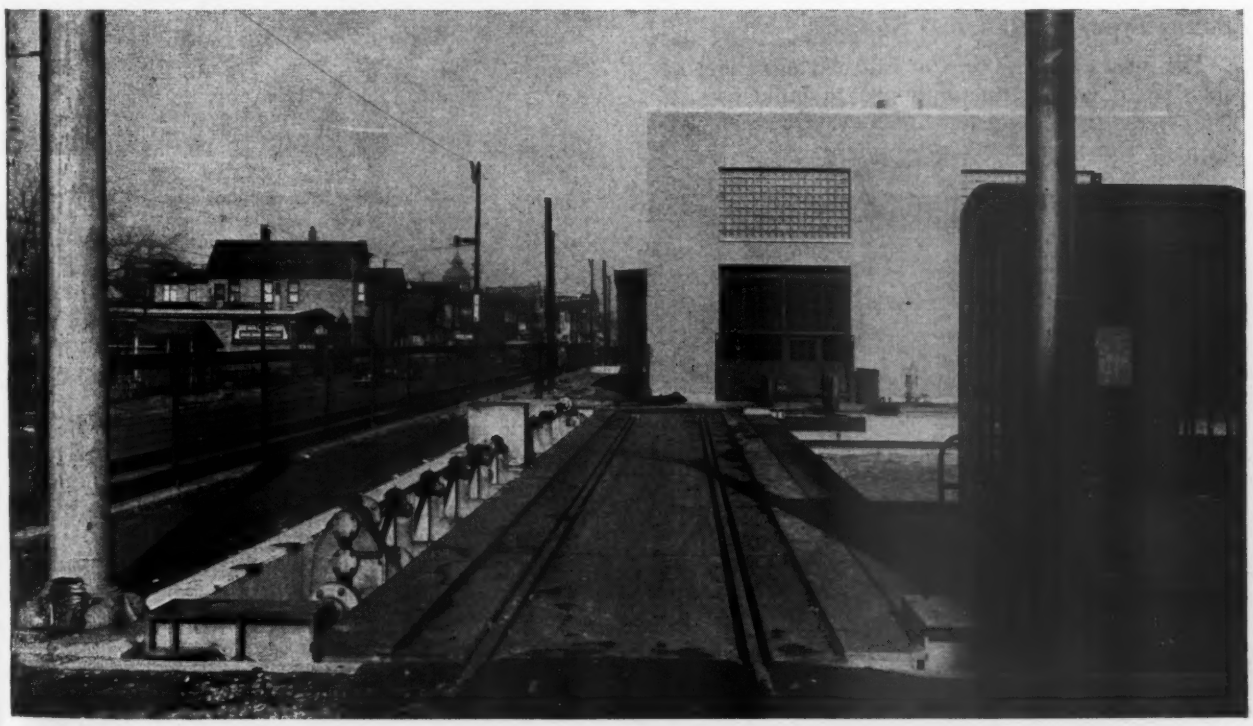
THERE has not been a great deal of activity over the past few years in building completely new passenger car repair facilities. There have been constructed a few new passenger car repair shops, or parts of repair shops such as new buildings. Modernization of the interior of part or all of existing buildings has been more prevalent, and many shops have installed new machinery and materials-handling equipment.

Where new shops have been built or old ones modernized the end results have had several things in common. Good lighting has been attained through large glass areas, either in the form of windows or glass-block construction, aided and supplemented by fixed installations of incandescent and fluorescent lighting, and by conveniently spaced outlets for portable lighting where the permanent-fixture illumination does not reach. More space has been provided for applying and removing sub-assemblies, such as air-conditioning units, and for the operation of power trucks over concrete floors. What is perhaps the most easily noticeable improvement in the overall passenger car repair facilities has occurred in the design of paint spraying rooms.

One reason for the apparently greater interest activity in painting facilities than in passenger car repair facilities generally is the changeover from dark inside and outside colors to pastel interior and bright exterior finishes designed for eye appeal. The lighter and brighter finishes require more care in application for good appearance, and in some cases, repainting must be done more often to compensate for the more frequent cleaning required with the lighter-color finishes.

The modernization of older passenger equipment has also increased the load on the paint shop. In order to get the maximum advantage from any mod-

An example of modern design in a transfer table and in a shop building



ernization work done on a passenger car it is of course necessary to give it a modern finish similar to that on the new equipment. In many cases this entails the removal of the existing varnish or paint from doors, sash, walls, etc. The surfaces then must be repaired either by patches, or glazing or puttying, and by sanding smooth, after which the necessary undercoating and final finishes must be applied. All this makes improved painting facilities increasingly desirable, as it creates additional work for the painting department because of the actual painting required and because attractive color schemes must be devised to match new equipment installed in the car.

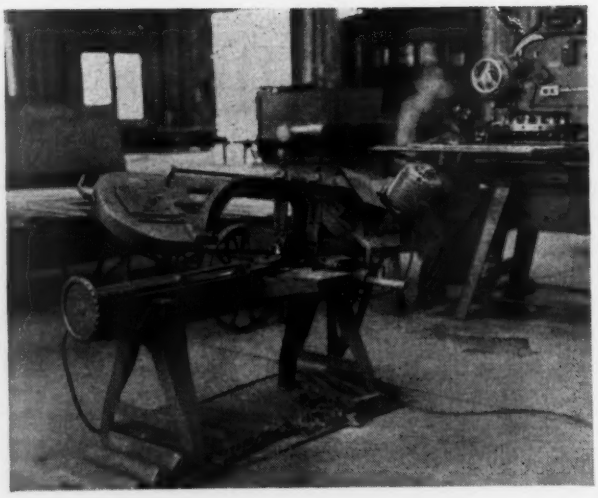
As with painting, mechanical and electrical repairs are likewise becoming more complex as a result of the continually increasing number and complication of the pieces of equipment applied to passenger cars. This problem has been receiving increased attention not only with a view toward making the necessary repairs successfully by as well to making them in a minimum of time because of the high cost of today's passenger equipment. With an average price tag of some $100,000 on the modern passenger car it must necessarily have its repair and servicing time reduced to a minimum in order that maximum mileage might be secured and its cost justified.

This has affected two phases of the passenger car repair shop, the physical plant and the training of personnel. It has made increasingly desirable the use of the specialist in one particular item of equipment rather than a general tradesman with a working knowledge of his general type of work, such as a machinist or electrician, in all pieces of equipment. The specialists must have a sufficient overall knowledge of their line of equipment that they can find as well as repair trouble and that they will know the type and seriousness of defects which will render their unit inoperative.

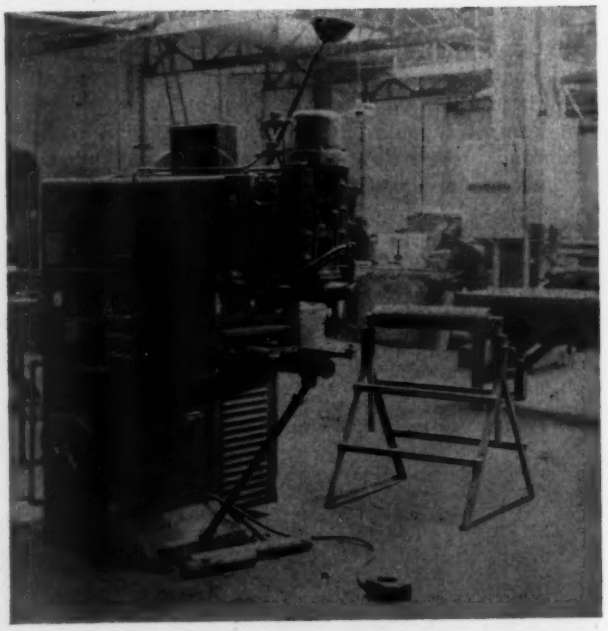
Some Types of Railroad Shops

The most complete type of railroad passenger car shop is, of course, one equipped to build cars, although this type is in the minority. One such type of shop recently built serves as an example of what may be done along these lines and as an example of some of the heavy equipment that is useful in repairing as well as building cars.

The main coach building is 136 ft. by 316 ft. and has 14 single-car tracks spaced 22 ft. on centers. One track has a pit underneath to facilitate inspection and other work underneath the cars. The roof is of the saw-tooth type with a clear inside height of 24½ ft. It is supported on light structural steel towers instead of the usual heavy single-column center posts; the towers serve also as guides and supports for adjustable scaffolding. This type of construction simplified the overhead steel structure, made erection easier, saved over 20 per cent in the amount of steel used,



A band saw and an indexing punch press in a passenger-car tin shop



The use of spot welding in passenger car work has prompted the installation of both fixed and portable spot-welding units

Ample shop space permits the use of power trucks and facilitates the removal of large sub-assembly units

and provided ample room for power lift trucks to operate in the aisles between the cars.

Permanent Adjustable Scaffolding

The scaffolding in this shop is counterbalanced to 100 per cent of its weight and may be easily moved up or down on the steel towers with one hand and positioned by inserting pins to hold it at any desired elevation. The scaffolding platform on each side of each track is in three sections, one 24-ft. length in the center and a 32-ft. length on each end. The scaffolding is so designed that it has a maximum height to which it may be adjusted of 14 ft., which is fixed by stops welded to the supports. The counterweight is completely enclosed at all times to eliminate any hazard from falling. Light steel ladders bolted to the towers give access to the scaffold at any elevation.

Shop for Building Trucks

A new shop building for constructing trucks was also added to the facilities. It occupies a space about 55 ft. by 455 ft. and has a distance between the concrete floor and the lower chords of the roof trusses of just under 19 ft. It has two tracks, 16 ft. apart on centers, which extend the greater part of the length of the shop. The building is served by a 15-ton overhead traveling crane which travels on rails 14⅓ ft. above the shop floor. It is operable either from the floor or from the usual cab. The truck shop is also equipped with a press for removing and applying truck bolster springs.

One end of the shop has a low-roof brick extension which houses three 40-ft. wash tracks and a paint spray shop 11 ft. by 40 ft. The spray shop has an exhaust fan with an exhaust pipe extending up through the roof to dispose of paint spray fumes safely. The floor directly under the trucks being sprayed has a steel grating over a partially filled water pan which collects surplus paint and eliminates the necessity of periodically scraping paint accumulations from the floor. Electric lighting installed in the spray booth is vapor proof.

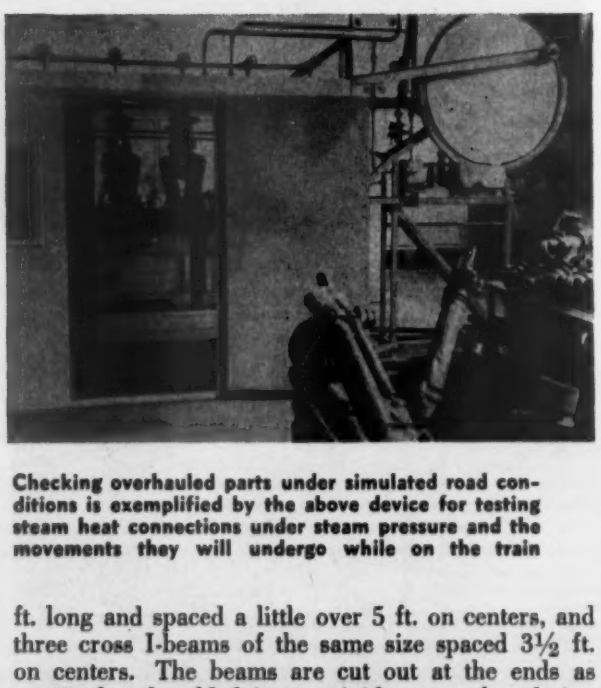
Device for Squaring Trucks

A highly useful feature of the shop is a truck-squaring jig which consists of two 20-in. I-beams 10

Portable scaffolding can be easily wheeled into place and leaves the aisles clean when it is not in use

Wide aisles and good scaffolding design make easy movement possible to any point in the shop

Steel towers in this shop support both the roof and adjustable scaffolding—Safe entrance into the car ends is provided by portable steel stepladders



Checking overhauled parts under simulated road conditions is exemplified by the above device for testing steam heat connections under steam pressure and the movements they will undergo while on the train

ft. long and spaced a little over 5 ft. on centers, and three cross I-beams of the same size spaced 3½ ft. on centers. The beams are cut out at the ends as required and welded into a rigid square foundation structure. The jig is placed over one of the tracks in the shop, but is a self-contained unit which does not have to be bolted or otherwise secured to the shop floor.

Four wheel-positioning V-blocks are installed one at each corner of the jig. One pair is fixed in position by welding to the I-beam flanges while the other is moveable by means of imposed racks and gears. This makes the jig adjustable to accommodate trucks with different wheel spacing.

The four V-blocks are so positioned on the jig that when they support two pairs of mounted car wheels the axles are accurately parallel. The wheels are further held in accurate position by being forced against positioning plates.

After the truck building is completed the trucks go to the spray booth where two coats of truck enamel are applied, each coat being allowed approximately four hours to dry.

A Modern Shop for Heavy Repairs

A comparably efficient modern passenger car shop, but which is designed for heavy repairs rather than both repair and building, utilizes steel and brick construction with large portions of the wall area composed of hollow glass blocks. In this repair facility all repair work except that done in an adjacent truck shop building is performed under one roof. The building contains the following supplemental shops: A steel and machine shop 76 ft. by 109 ft., a cabinet shop 50 ft. by 109 ft., an electrical shop 42 ft. by 62 ft., a pipe, tin and air shop 62 ft. square, and a general storage room 50 ft. by 122 ft. Partitions between these rooms and any adjacent rooms or the main part of the coach shop are of brick.

The complete structure is 252 ft. by 339 ft. The coach repair portion occupies 202 ft. by 230 ft., and the paint shop, 50 ft. by 116 ft. The remainder of the building is taken up by a toilet and locker room and by the various sub-shops. Entering the building through vertical sliding doors are ten tracks, eight of which serve the coach repair shop and two the paint shop.

The eight repair tracks in the main shop are spaced at 25-ft. centers to provide ample clearance between them for workmen, tools and portable scaffolding. The two most westerly tracks are equipped to handle heavy work, such as straightening center sills or other underframe members. Located along each repair track are series of electrical outlets with 440, 220 and 110 volts a.c. for operating shot welders, arc welders and various portable tools and hoists.

An overhead tramway at each of the heavy repair tracks accommodates 1-ton chain hoists to facilitate positioning shot welding equipment when repairing stainless-steel cars.

Adjacent to the main shop building and across the transfer table is the truck and blacksmith shop. This structure is 47 ft. by 107 ft. and also utilizes glass block panels extensively. Two truck repair tracks enter the building from the transfer table. In each is a pit containing a spring compressor to aid in dismantling trucks, and above each is a 10-ton overhead crane. An area 47 ft. by 50 ft. in one end of the building is given over to the welding and blacksmith shop. This shop contains a forge, a drop hammer and other smith tools.

Like the car-building shop, this car-repair shop also features an unusual but highly efficient scaffolding arrangement. All scaffolding used in this shop, with the exception of that installed in the paint-spray-booth section, is of the portable type. All large scaffolds are mounted on four wheels for easy movement to any point at which they are needed in the

building. The use of portable scaffolding units leaves the aisles completely free for the movement of power trucks and for removal of air-conditioning units and battery boxes. The portable scaffolding can also be used with ease across the ends of the cars.

When all repairs are completed to both the car body and to the trucks and fittings which have been removed, the work preliminary to painting, such as plastering and sanding, is performed. In the final steps the car is painted in combination spraying booths and drying ovens and set either outside or back in the coach shop for the reinstallation of the furniture and trimming.

Trucks may be applied either before or after painting. If applied prior to painting the car body, the trucks are sprayed at the same time the body is painted. If applied after body painting, the trucks are first sprayed separately in the combination booths.

Combination Spraying-Drying Booths

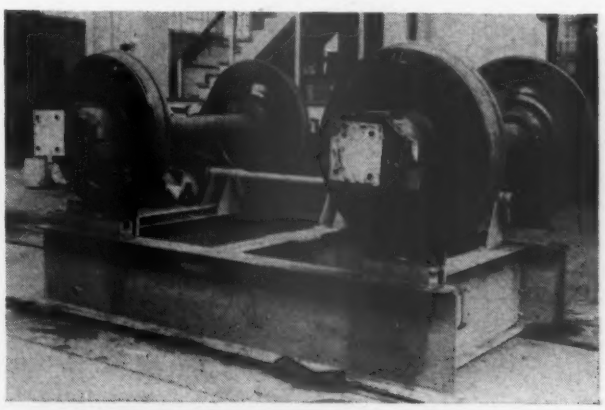
Painting facilities in this shop comprise two combination spraying and drying booths each of which is supplied with clean filtered air, equipped with thermostatic control for maintaining the desired temperature for painting or drying, and has filtering units for removing the paint particles from the air before discharge to the atmosphere. Air enters the booth through diffusers in the ceiling at the front end and flows towards the rear where two batteries of filtering units remove paint particles from the air as it passes through a spray containing a mixture of water and a special compound which coagulates the paint upon contact. After coagulation, the paint is carried by the water to a settling tank where it collects on the surface and is later removed.

A Single-Track Spray Booth

Another solution to the problem of providing adequate ventilation for workmen's health and comfort, and sufficient warm air to dry the newly painted cars rapidly, is a single-track installation in a section of an existing repair shop. The area was walled off and equipped with the necessary facilities for painting and drying cars and small parts. The painting section is 16 ft. high, 19 ft. wide and 110 ft. long. One end has a door for entry and exit of the cars which is closed during the painting and drying operation. The opposite end has a water wall through which contaminated air is drawn before being exhausted.

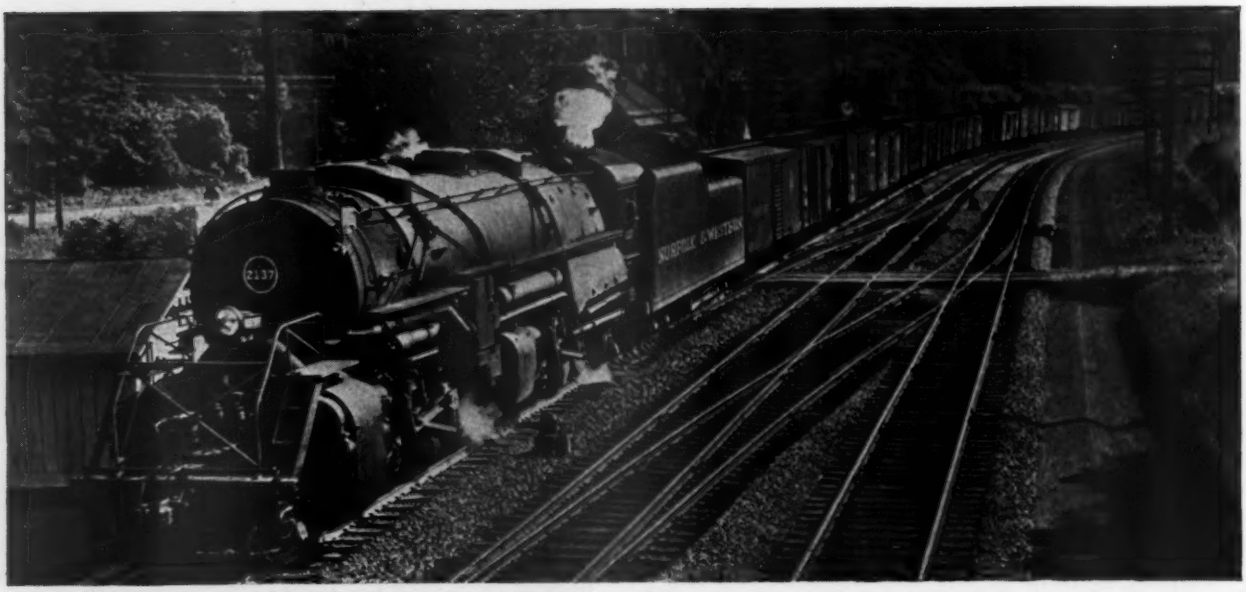
At one end of this shop is a spray booth 16 ft. square for small parts. This, like the main spray booth, has a water wall which removes tiny globules of paint from the air to be exhausted. Both the main and the small-parts spray booth have explosion-proof fluorescent lighting fixtures.

The shop has two 7½-hp. fans at the fresh air supply end of the shop coupled with four variable temperature heater sections. This permits any temperature variation necessary in the fresh air supply of 45,000 cu. ft. per min. The temperature variations are automatically controlled by a room thermostat in parallel with a low-limit air-stream thermostat. The variable-temperature heater sections are so designed that the heating unit is continually under full steam pressure to eliminate damaging the tubes by freezing. Reduction in air temperature is accomplished by changing the damper position and not by reducing steam pressure. Two 15-hp. fans exhaust the contaminated air from the main spray booth, while the small parts booth has two 3-hp. fans for this purpose.



A truck-squaring jig increases the accuracy of the truck assembling

Assembling trucks in a modern passenger-car truck shop



Compound Mallets have proven highly successful in mountainous operation on the N. & W. and attain speeds of 45 to 50 m.p.h. on both tonnage and time freight where operating conditions permit

The Change In Motive Power

A general review of recent motive power trends and some examples of accomplishments on individual roads

THE magnitude of the change of the relative portions of work done on U. S. railroads by the principal types of locomotives, and the rapidity with which this change took place, is shown in figures published by the I. C. C. from reports filed with the commission by the carriers. In passenger service coal-burning steam power handled 63.7 per cent of the car miles in 1941, 44.3 per cent in 1947 and 36 per cent in 1948. Oil-burning steam locomotives powered 22 per cent of the car miles in 1941 and 1947, and 18 per cent in 1948. The percentage handled by electric locomotives remained approximately constant over this period at 6.5 per cent. The Diesel-electric locomotive, however, increased its share of the total passenger-car miles from 7.8 per cent in 1941 to 27.2 per cent in 1947 and to 39.5 per cent in 1948.

A similar trend has occurred in yard switching work. In 1941 coal-burning steam locomotives' share of the hours of yard switching performed was 75.8 per cent; by 1947 its share had dropped to 58.3 per cent, and by 1948 to 53.7 per cent. Oil-burning steam power's share for the three years was 10.8, 8.7 and 8.1 per cent. As in passenger work, the electric locomotive share remained about constant, performing about 1.25 per cent of the yard switching locomotive hours in all years since 1941. The proportion of hours handled by Diesel switchers rose from 12 per cent in 1941 to 31.8 per cent in 1947 and to 37 per cent in 1948.

In freight service the proportion of gross-ton-miles hauled by coal-burning steam power declined less than equivalent figures in passenger and yard service. The drop was from 79.7 per cent in 1941 to 66.9 per cent in 1947 to 59.5 per cent in 1948. At the same time the proportionate rise of the Diesel locomotive was greatest in freight service, rising from 0.22 per

TABLE I—FREIGHT TRAIN PERFORMANCE—36 LARGE RAILROADS

Railroad	Freight service gross ton miles per train hour‡ 1940 (Ten Months)	1948	Per cent increase	Percent of total g.t.m. handled by Diesels in 1948	Miles per loco. per day
Eastern District:					
Delaware & Hudson	33,609	54,066	60.9	2.839	70.9
Reading	27,825	35,064	26.0	19.73	72.2
Boston & Maine	27,911	34,447	23.4	85.31	110.8
New York, Chicago & St. Louis	40,693	49,854	22.5	.05	135.6
Erie	46,709	54,848	17.4	39.14	71.7
Wabash	39,304	44,993	14.5	.04	111.0
Delaware, Lackawanna & Western	37,132	41,525	11.8	44.76	87.2
New York, New Haven & Hartford	28,818	32,174	11.6	65.22	102.5
Lehigh Valley	46,405	51,276	10.5	7.45	99.4
Baltimore & Ohio	30,519	32,734	7.3	10.70	76.4
New York Central	38,494	38,191	d .8	9.39	91.4
Pennsylvania	38,484	38,061	d1.1	8.44	77.1
Pocahontas Region:					
Norfolk & Western	57,971	62,939	8.6	.....	97.1
Chesapeake & Ohio*	49,340	53,555	8.5	.07	81.7
Southern Region:					
Gulf, Mobile & Ohio†	33,466	55,014	64.4	94.95	91.4
Illinois Central	31,371	43,691	39.3	.....	89.1
Seaboard Air Line	26,272	35,197	34.0	57.69	94.9
Southern	23,452	29,553	26.0	38.30	81.1
Atlantic Coast Line	23,835	27,744	16.4	31.57	76.5
Louisville & Nashville	28,247	28,793	1.9	.12	107.6
Western District:					
Chicago, Burlington & Quincy	33,044	48,132	45.7	47.84	83.5
St. Louis Southwestern Lines	34,013	45,199	32.9	32.33	137.9
Union Pacific	44,094	58,282	32.2	21.33	108.3
St. Louis-San Francisco	27,850	36,236	30.1	14.90	84.0
Atchison, Topeka & Santa Fe	37,872	49,005	29.3	33.03	112.8
Missouri Pacific	33,650	43,226	28.5	27.10	114.2
Chicago, Rock Island & Pacific	30,022	38,509	28.3	26.03	103.2
Missouri-Kansas-Texas Lines	30,474	38,901	27.7	31.46	144.9
Northern Pacific	35,116	43,742	24.6	24.57	74.5
Denver & Rio Grande Western	30,826	38,057	23.5	50.99	76.7
Texas & New Orleans	29,547	36,417	23.3	.16	125.8
Southern Pacific Co.	38,037	44,978	18.2	13.17	91.1
Great Northern	38,663	44,392	14.8	30.18	79.2
Chicago & North Western	30,165	33,796	12.0	24.58	79.6
Chicago, Milwaukee, St. P. & Pac.	31,567	34,514	9.3	18.12	94.4
Texas & Pacific	39,306	42,402	7.9	1.55	139.2

(Note: Data from I. C. C. Bureau of Transport Economics and Statistics Monthly Comment, dated Jan. 11, 1949.)
* Includes Pere Marquette because of merger in 1947.
† Includes the Alton because of merger in 1947.
‡ Based on gross ton-miles of cars, contents and cabooses.
d Decrease.

TABLE II—PERFORMANCE DATA—FREIGHT MOTIVE POWER

	1948	1947
Train miles total (000)	584,541	615,942
Diesel	101,644	62,637
Steam	473,438	543,361
Road locomotive miles—total (000)	663,506	703,470
Diesel	109,182	67,049
Steam	542,002	623,871
G.t.m. (excl. locomotive and tender)	1,443,410	1,478,598
Diesel	307,013	182,971
Steam—oil	248,913	275,707
Steam—coal	858,268	989,545
Train hours, total (000)	36,171	38,443
Diesel	4,731	2,895
Steam	30,857	34,955
Average locomotive mile per train mile	1.07	1.08
G.t.m. per train mile	2,500	2,432
Train mile per train hour	16.2	16.0
G.t.m. per train hour	39,905	38,462

Note: Data from I. C. C. Statistics of Freight Train Performance, Statement No. M-211.

cent in 1941 to 21.3 per cent in 1948. Oil-burning steam power rose slightly from 17.8 per cent in 1941 to 18.7 per cent in 1947, then dropped to 17.3 per cent in 1948. Electric power also declined slightly from 2.3 per cent to a little over 2 per cent during the 1941-48 period.

One important factor which should not be overlooked, however, is that while the steam locomotive has declined relatively in the proportion of total work done on the railroads, its actual decline in the amount of work done has been slight. In freight service, for example, the gross-ton-miles handled by coal-burning and oil-burning steam locomotives combined remained nearly the same for 1948 as for 1941.

Another way of looking at the still-important role of the steam locomotive is to compare its coal consumption in 1948 with that in 1941. Due to increases of 20.8 per cent in total gross-ton-miles in freight service, 20.1 per cent in passenger-train-car-miles and 15.4 per cent in yard switching hours in 1948 over 1941, the total tonnage of locomotive coal consumed dropped a little over 10 per cent. Thus the steam locomotive is still doing nearly as big a job on the railroads as it did in 1941.

Freight Operating Statistics

Table I is compiled from reports of the carriers to the I. C. C. It compares performance on 36 large U. S. railroads in 1948, when Diesel operation accounted for roughly one-fifth of the total gross-ton-miles, with their performance in 1940, when Diesel operation was negligible.

Five railroads increased their gross ton miles per train hour by more than one-third. The Gulf, Mobile & Ohio, which is 95 per cent Dieselized in freight service, had the largest percentage increase, 64.4 per cent. Second place went to the Delaware & Hudson which had a 60.9 per cent gain with 2.83 per cent of its total gross ton miles handled by Diesel power. The Burlington, which is fifth in the percentage of total gross ton mile handled by Diesel locomotives, had the third largest percentage increase, 45.7. The Illinois Central handles all its freight trains with steam power and had the fourth largest improvement, one of 39.3 per cent. The Seaboard, nearly 58 per cent Dieselized on a g.t.m. basis, had a 34 per cent gain in gross ton miles per train hour, puting it in fifth place on a percentage increase basis.

Improvements by Districts

Considering each of the four districts as a whole, it is found that the Western District, with 26 per cent of the total gross ton miles handled by Diesel locomotives, had the largest percentage increase in gross-ton-miles per train hour, 26.2. The Southern Region, also 26 per cent Dieselized, had a percentage increase of 23 per cent. The Pocahontas Region had less than one per cent of its total gross ton mileage hauled by Diesels and had an increase of 8.3 per cent. The Eastern District was a little over 15 per cent Dieselized and showed an increase of 7.7 per cent.

The Pocahontas Region led the other three in gross ton miles per train hour with a figure of nearly 56,000. The Western District was second, with nearly 43,000 gross ton miles per train hour. The Eastern District average was 36,800, and the Southern Region a little over 33,000 g.t.m. per train hour. The overall average for all four regions rose from 33,859 in 1940 to 39,782, in 1948.

Returning again to an interpretation of Table I, it can be seen that what correlation exists between the degree of Dieselization and the percentage increase in a railroad's gross-ton-miles per train hour is most

TABLE III—SELECTED STATISTICS, MOTIVE POWER AND FREIGHT TRAIN PERFORMANCE

Month 1948	Total Freight locomotives	Unservice-able	Stored	Active	Per cent	Locomotive miles (000)	G.T.M. (000,000)	Freight train miles (000)	Freight car miles (000,000)
January	21,111	3,268	655	17,188	81.4	57,726	115,899	50,630	2,510
February	21,132	3,440	724	16,968	80.3	54,802	113,025	48,101	2,449
March	21,183	3,464	974	16,745	79.0	55,286	114,324	48,865	2,550
April	21,132	3,352	1,270	16,510	78.0	49,301	108,639	43,648	2,406
May	21,044	3,398	1,120	16,526	78.5	56,815	127,413	49,863	2,769
June	20,933	3,356	969	16,608	79.5	55,245	122,836	48,522	2,662
July	20,871	3,225	973	16,673	79.8	55,984	122,986	49,345	2,660
August	20,893	3,244	884	16,765	79.8	66,934	128,469	50,201	2,760
September	20,908	3,162	917	16,829	80.4	55,050	123,195	48,545	2,659
October	20,872	3,137	926	16,809	80.7	58,776	132,496	51,863	2,859
November	20,817	3,292	1,029	16,496	79.3	54,341	119,737	48,075	2,619
December	20,753	3,152	1,301	16,300	78.9	53,257	114,288	47,275	2,540
1949									
January	20,489	3,206	1,471	15,812	77.2	50,247	107,211	44,948	2,381
			Total for 12 months—1948:			663,506	1,443,410	584,941	31,444

Note: Data from I. C. C. Statistics of Freight Train Performance, Statement No. M-211, and Statistics of Motive Power, Statement No. M-240.

apparent in the Western District. What relationship does exist between the two sets of figures is most apparent in this district, although there are a number of exceptions. For example, the St. Louis-San Francisco with the fourth largest percentage increase in gross ton miles per train hour is Dieselized to a smaller extent than all but three of the twelve roads below it on the list. Similarly, the Denver & Rio Grande Western which is over 50 per cent Dieselized on a g.t.m. basis had about the same percentage increase as the Texas & New Orleans with 99.8 per cent steam operation.

The Southern region would show a fairly regular pattern between the degree of Dieselization and the percentage increase in gross ton miles per train hour except that the Illinois Central, with 100 per cent steam freight operation, has the second highest percentage increase in that region and is also second in gross ton miles per train hour. Figures for the Eastern District, which had the smallest percentage increase in gross ton-miles per train hour, show little or no correlation.

The Pocahontas region had an increase percentagewise only slightly greater than the Eastern District. However, the operation of the roads in this region was already at a high level in 1940. The Norfolk & Western's 1940 figure of 57,971 gross ton miles per train hour is exceeded in 1948 only by its own per-

A 5,400-hp. Diesel handling a long drag freight through the Montana Rockies

formance and slightly by the Union Pacific figure of 58,282 gross ton miles per train hour.

Additional Factors

Unfortunately a listing such as Table I does not, and probably could not, take into consideration all the factors involved in comparing the effectiveness of today's freight motive power with that of 1940. There would be a vast difference, for example, in the percentage increase in gross ton miles per train hour that should be expected from a road that was well equipped with modern 2-8-4's or 4-8-4's in 1940, as compared to a second road which had to rely on light and ancient 2-8-2's in that same year.

Motive Power Modernization Programs

While the mechanical department plays an important role in furnishing and maintaining locomotives for optimum operating results, it has an equally important part to play in keeping maintenance and operating costs at a minimum. New power has always been one way, and a good way, of improving operation and reducing costs, and it is recognized as one means of attaining both these desirable objectives. A second means, however, which is often underestimated in its value is that of modernizing older locomotives. The experience of the Chicago and North Western with a fleet of heavy freight locomotives serves as a good example of what can be accomplished along these lines.

The first in a group of 20-yr.-old Class H locomotives modernized by the Chicago & North Western recently received its third annual inspection since modernization in 1946.* The locomotive was gone over carefully at this time and the railroad was well satisfied that the cost of modernizing the Class H's which was about twice what the cost would have been for the Class 2 repair for which they were due, had resulted in maintenance savings which repaid the modernizing cost in less than three years of service. Over and above the reduction in maintenance charges, substantial savings in fuel and an increase in availability were realized.

Among the principal changes made were new cast-steel bed-frames, enlargement and streamlining of steam and exhaust ports, roller bearings on all axles, light-weight reciprocating parts, larger boiler tubes, flues and superheater units, the application of two new Thermic syphons in the firebox and two in the combustion chamber, an all-welded firebox and tuyere-type grates. The beneficial effect of the modernization plus careful maintenance, including the use of a transit for precision laying-out of the frame, shoes and wedges, guides and rods, and for aligning engine and trailer trucks, has resulted in some outstanding records of wear, typical of which is the following data on locomotive 3004, which has just completed over 300,000 miles of service and has undergone its third annual inspection:

1. The valve and cylinder bushings were in excellent condition. It was not necessary to bore either the valve or cylinder bushings during the 3 years of service. The cylinders still used 27-in. diameter packing. Evidence to date is that these bushings will go the entire term of service.
2. The same shoes and wedges were still on the 3004 that were placed there in April, 1946, when the locomotive was modernized. These

* A detailed description of the modernization of the Class H locomotives appeared on page 295 of the June, 1946 *Railway Mechanical Engineer*.

TABLE IV—VARIATIONS IN THE STATUS OF ACTIVE LOCOMOTIVES

	Locomotives On Line						Stored Serviceable						Locomotives Awaiting Repair					
	Jan. 1948–Mar. 1949			Change from Previous Year			Jan. 1948–Mar. 1949			Change from Previous Year			Jan. 1948–Mar. 1949			Change from Previous Year		
	Steam	Diesel*	Elec.	Steam	Diesel*	Elec.	Steam	Diesel*	Elec.	Steam	Diesel*	Elec.	Steam	Diesel*	Elec.	Steam	Diesel*	Elec.
Jan.	34,800	5,850	821	−2,455	1,334	− 9	896	0	6	−451	0	−2	2,483	105	38	−654	12	7
Feb.	34,729	5,987	819	−2,343	1,356	−11	958	0	6	−321	0	−2	2,581	130	38	−594	31	0
Mar.	34,586	6,146	816	−2,308	1,405	−14	991	0	9	−293	−1	0	2,702	125	30	−429	27	−10
April	34,421	6,319	818	−2,204	1,508	−12	1,446	0	12	79	−1	3	2,873	128	34	−172	40	− 7
May	34,251	6,529	820	−2,227	1,646	−10	1,898	0	15	621	−1	+6	2,879	113	36	−132	0	− 7
June	34,109	6,701	820	−2,041	1,732	−10	1,709	0	11	439	−1	1	2,887	102	28	55	3	− 8
July	33,968	6,866	820	−2,008	1,775	−7	1,504	0	14	226	−1	2	2,803	104	30	68	24	− 6
Aug.	33,752	7,019	820	−2,080	1,799	−2	1,421	0	10	45	−1	3	2,774	104	25	−4	9	−15
Sept.	33,608	7,143	820	−2,006	1,838	−2	1,366	2	12	123	−2	9	2,792	98	26	83	10	2
Oct.	33,331	7,385	818	−2,060	1,992	−4	1,415	2	11	268	2	5	2,713	112	27	7	1	−15
Nov.	33,111	7,613	811	−2,147	2,051	−11	1,394	2	8	426	1	2	2,646	107	35	0	−14	−10
Dec.	32,854	7,884	829	−2,158	2,184	7	1,490	3	7	636	2	−1	2,600	117	38	−12	15	4
Jan.	32,613	8,183	829	−2,187	2,333	8	1,852	2	10	956	2	4	2,439	106	25	−44	1	−13
Feb.	32,374	8,407	828	−2,355	2,420	9	2,140	2	6	1,182	2	0	2,479	139	31	−102	9	− 7
Mar.	32,095	8,618	827	−2,491	2,472	11	2,415	0	6	1,424	0	−3	2,504	138	36	−198	13	6

* Diesel Locomotive Numbers Refer to Units.
Note: Data from I. C. C. Statistics of Motive Power and Car Equipment, Statement No. M-240.

TABLE V—DIVISION OF THE WORK DONE BY MOTIVE POWER IN FREIGHT AND SWITCHING SERVICE

	Road freight miles (000)			Freight train switching miles (000)			Yard switching hours—freight		
	Steam	Diesel	Elec.	Steam	Diesel	Elec.	Steam	Diesel	Elec.
1948	542,002	109,182	12,318	46,561	4,306	687	35,518	20,039	330
1947	623,871	67,052	12,547	49,817	2,709	642	38,918	17,552	344

Note: Data from I. C. C. Statistics of Freight Train Performance, Statement M-211, and Statistics of Yard Service, Statement M-215.

shoes and wedges have made 300,000 miles. By using oversize floating plates at the second and third drivers the shoes and wedges give evidence of going the full term of service.

3. The crank pins at the second, third and fourth wheels are three years old and have run 300,000 miles. Sufficient stock remains on them to bring them into quarter and run for at least another year.
4. Locomotive 3004 was equipped with bronze-lined steel valve guides. These guides were in good condition and are suitable for another year of service.
5. The Hulson tuyere-type grates will need little attention for at least another year.

From the examination of the machinery, the railroad considered that it was becoming more clearly evident that the limiting condition for a "Term of Service" for the 3004 would be the tube-and-flue-removal period. The machinery held up well enough to last as long as the tubes and flues. If a tube and flue time extension appears advisable, the machinery might very well last a full 5 years, or 450,000 miles.

The Shop and Engine Terminal

Virtually all new shop and enginehouse terminal construction on most roads has been devoted to the servicing and maintenance of Diesel power. These buildings, some built and equipped at costs up to several million dollars, reflect the value of modern shop engineering. The buildings are compact. Space is available where it is needed but none is wasted. Material handling has been given careful consideration with a view toward reducing this large and controllable item of maintenance expense. The buildings are well lighted by both natural and artificial illumination, and are well ventilated for workers' comfort.

The exact opposite applies to the average steam locomotive shops. Lighting is usually poor and ventilation none too good. Not enough attention has been given to material handling nor to the distances over which materials must be transported. The average steam locomotive shop has too much total area but not enough space in many parts for handling up-to-date power. The movements not only of materials, but of workmen as well, is longer than necessary. And what applies to back shop applies doubly to roundhouses. The amount of waste movements that could be eliminated by substituting straight-line engine-houses for the conventional roundhouse for ordinary locomotive servicing and light repairs is worth thorough study.

What can be done along these lines in the style of the layout and in the results obtained is shown by the Norfolk & Western. With the use of good shop and engine terminal facilities the entire fleet of Class A 2-6-6-4 locomotives averages over 200 miles per day per locomotive, and exceeds the mileage attained by the average road freight Diesel locomotive. The entire fleet of Norfolk & Western Class J 4-8-4 passenger locomotives averages nearly 500 miles per day.

Another road which has done a creditable job in keeping steam facilities up to date is the Nickel Plate. Its average mileage per locomotive per day for all freight locomotives exceeded 135, and was by far the highest of any Eastern District railroad listed in Table I. In fact this was exceeded by only three other railroads in the entire country, and these were in the Western District where major terminals are much farther apart.

What modernization has been done to steam locomotive shops has been largely piece-meal. While the purchase of a few new machines for a shop has invariably proved to be an excellent investment, a small percentage of new machinery in a shop will no more make that shop modern than would the application of roller bearings make a 'Niagara" out of an 1890 Consolidation.

Future Motive Power Prospects

While no one factor will decide the relative popularity of the various types of locomotives in the future any more than it has in the past, economics of the fuel supply appear destined to play an ever increasing role in deciding what type of locomotive will haul tomorrow's trains. At the present time the three principal types of fuel—coal, residual fuel oil and Diesel fuel oil—are all in reasonable abundance. The continuance of a peace-time economy should result in a sufficient quantity of each type, with the price tag being determined by the relationship between supply and demand. The price tag, in turn, will determine the uses to which each type can be put efficiently and economically.

The big question that remains unanswered about liquid fuels is what war might bring. How much would the needs of the armed forces increase? How much would an emergency reduce our imports and how much increase our exports?

A second question, which is applicable equally to a war-time or a peace-time basis, concerns the relaxation of Diesel fuel specifications. If any such modifications can be made economically, and without adverse effect on Diesel maintenance, operation or availability, it may help to meet the continually increasing needs for Diesel fuel oil and help keep the price low by increasing the supply. But this question in turn raises several more.

Where the additional Diesel fuel is obtainable at the expense of residual fuel oil, how much will the cost of production rise? Where it is done at the expense of home-heating oils, will the railroads, with their large requirements, be willing to bid against the price the individual home owner, with his comparatively small consumption, is willing to pay? Where this may be done at the expense of kerosene or gasoline, will the railroads be in a position to compete on a price basis with the government for the latter's requirements for kerosene and other blends of fuel for jet-propelled planes and gasoline for piston-engine

planes, and for truck, bus and automobile gasoline against the millions of owners of these highway vehicles?

While tests have already been run on the Chicago, Burlington & Quincy using synthetic Diesel fuel oil, the consensus among leading authorities on petroleum and synthetic liquid fuels indicates that natural petroleum products will have to be the chief source of oil supply for several decades.

Liquid fuels can be synthesized from coal as well as from gas, but not as rapidly or as cheaply. The process would require the opening of new mines, and employing miners yet to be trained. To produce a million barrels of oil a day from coal by present methods would require the erection of plants costing some five billion dollars. Their coal consumption would be about 650,000 tons a day or 236 million tons per year. To produce all of the country's present demand for petroleum products from bituminous coal would require twice as much bituminous coal as was mined in 1941.

The use of sub-bituminous coal has been advocated to get raw materials more cheaply and without competing with other uses for bituminous coal. Authorities caution against relying on this source for synthetic liquid fuels until more and better data are available.

The prospect of obtaining large quantities of oil from shale and tar sands is considered slightly more remote than from synthesis. Extraction processes are solvable, and plant construction costs not excessive, but the mining and handling of the great quantities of materials might create more serious manpower problems.

The quantities of synthetic fuel expected to become available through normal peacetime development in the next few years will seem large when measured by the technological achievement involved, and it will give by far the greatest volume of synthetic product ever produced. But measured in terms of total liquid fuel requirements, the synthetic fraction produced is apt to be small for several decades.

The Future of Solid Fuel

The coal situation can be summed up briefly by saying that the supply is plentiful but the quality often poor. The outlook for using coal of a type from which good performance can be obtained is better for two reasons than it has been since before the war.

Supply has caught up with demand. Abundance of coal will eliminate inferior grades from the market, and make it possible for the railroads to become increasingly selective in the types of coal they wish to burn. If the trend toward a buyers' market continues good grades of coal will be available to the railroads, and at a small enough price differential over mine run to justify the improved performance that will result.

Another reason for expecting better coal to be used is the increased interest being shown by railroad men in deciding what types of coal are best suited for locomotive operation and in getting those grades of coal. Greater use of sized coal may also be expected as a result of tests; one series showed that 95 lb. of mine run were burned per 1,000 gross-ton-miles compared to 66 lb. of sized coal.

Simplicity Vs. Maximum Efficiency

One final question is whether the skilled labor necessary to maintain highly complicated locomotives will be available to the railroads in sufficient quantity to justify more complex types of locomotives or increasing the complexity of any of the present types. Will the added efficiency gained by additional complication offset the advantages accruing from using less fuel and from other operating advantages?

C. & O. 2-6-6-6 which developed 7,498 drawbar horsepower 46 m.p.h., accelerated 160 loads (14,083 tons) from a dead stop to 19 m.p.h. in one mile, and to 29 m.p.h. in 11 minutes

Rolling-Stock Problems

Freight cars: Progress in weight reduction stalled. Passenger cars: Signs point to retreat from extremes in design

THE advent of new weight-saving structural materials 15 years ago marked the beginning of a new era of railway rolling-stock design. Its main objective was reduced weight. In one respect, however, it continued a well-defined trend of the years immediately following World War I. This was improvement, first, in the uniformity of strength of all cars in trains; second, improvement in the balance of the strength of the parts of the individual cars, and, third, closer approach to economic limits of life from the maintenance viewpoint.

The significance of these improvements in balance will become evident when some of the differences in operating conditions between World War I and World War II are recalled. During the earlier conflict, freight trains were made up of all-steel cars, cars with steel underframes and wood superstructures, cars of all-wood construction, but reinforced with steel center sills, cars of all-wood construction, reinforced with cast-steel draft arms extending back to include the bolster, and a few all-wood cars, not yet reinforced. Trains of such consists were not noted for their reliability and wrecks caused by complete failures of cars with relatively weak structures were frequent.

During the second world war the cars of weak structure had all disappeared and a substantial uniformity of structural strength had been attained throughout the freight-car inventory. Freight-train operation had thereby achieved what, by comparison, was clock-like regularity.

The new structural materials, while making lighter weight possible, conformed substantially to the standards of strength established for cars of carbon-steel construction. They offered possibilities of weight saving which went beyond the safe limit for the control of freight-train speed with the single-capacity AB brake. The ABLC brake was developed to overcome this limitation.

The weight-saving possibilities of the new structural materials of the middle 1930's were associated with other factors which added style and comfort influences to the new era of passenger-train car design. Air conditioning completely changed the outlook as to the use of color in interior decorations, and the discovery of the coach passenger subjected the coach interior to all the ingenuity the industrial designer was able to bring to bear on the problems of this new-found field for the application of his art. Starting with coach facilities, applications soon took in Pullmans and all thought of standard interior arrangement was abandoned. Such was the status of passenger car design when the war stopped all further construction.

Saved Freight-Car Weight

During most of World War II and the postwar period the central problem with respect to freight cars has been to secure an adequate supply of steel. This to some extent obscured the fact that progress toward the goals envisioned with the advent of the new structural materials and new techniques of construction has been disappointing.

Since the building of freight cars of substantially reduced weight became possible, several studies have been made to determine the value of reduced weight measured in tons per car. Several formulas have been developed which provide bases for evaluating the effect of weight reduction on each pertinent operating expense account under load-limit tonnage in tonnage trains, under load-limit tonnage in less-than tonnage trains, and in cars loaded with less than load-limit tonnage. Values determined from the application of these formulas vary, and none of them has gained wide acceptance.

However, up to the limitation imposed by the single-capacity brake, steady progress was made in the building of lightweight freight cars, box in which the economic advantage of reduced weight is less apparent, as well as in open-top cars where the economic advantage, according to formula, is greatest. The ABLC brake, however, with its price differential, has created a hurdle which is not being too readily cleared. Thus, the possibilities of a pay-load-gross-load ratio of more than 75 per cent have not been extensively realized.

The Real Freight-Car Problem

Of more direct effect on the character of freight-car purchases than the economics of saved weight is the relatively large percentage of freight-car time which is spent on lines other than those of the owning road. Even where the broad economic advantage of a kind of freight rolling stock which costs more than the base price required to replace existing cars of old standard construction is well established, the individual road cannot justify the purchase of equipment at premium prices for advantages only part of which it can realize. When traffic is heavy, box cars spend scarcely one fifth of their time at home; gondolas, between 40 and 50 per cent, and even hoppers, only slightly more than 70 per cent. And complicating the general situation are the present high prices for all cars.

Of course, railroads all get paid for the use of their cars when they are away from home. But the per diem system of reimbursement was developed and has been administered on the theory that one freight car is worth about as much as another and that normal variations of value during stable times will be about as broad as they are long as far as the individual road is concerned. So, in theory, a single daily rate can be applied to all cars. This simplifies the conduct of the whole system and avoids occasions for many disputes.

These assumptions were valid during a period when, for many years, no important changes were taking place in materials, construction techniques, methods of loading, or features of service. Prices were also relatively stable. New materials and new techniques of construction have effected marked changes during the past 15 years. Mechanization of loading and the growth of bulk shipments have created new requirements which must be met by freight cars if the shippers are to be satisfied. The demand for overnight deliveries over greater distances is increasing the number of freight trains which operate on schedules approaching those of passenger service.

These changes have all increased the rate at which old cars are growing obsolete and so have increased the need for new cars to keep the railroads in a reasonable state of health to meet the growing severity of competition.

Do Per Diem Rates Offer an Out?

Is there any remedy for the opposing interests of the individual railroad which has to pay for the cars and the railroad industry as a whole? It has been proposed that the government finance the purchase of

freight cars. This is a dangerous expedient with which few railway officers will be in agreement. Another suggestion is for the establishment of a graduated scale of per diem rates to be varied according to the cost of the car. This has reason behind it in a transition period when there is no stability with respect to car types, methods of loading, service requirements, and price. The problem is how to administer it.

Car accounting with a single universal per diem rate is simple to administer. The only fact which has to be established is the presence of the foreign car on the line. A graduated scale of per diem rates has at least one more fact which must be established: the rate category in which the car belongs. This will require a system of marking such that the answer will be as readily discernible as is the ownership of the car. Furthermore, the correctness of the designation should be verifiable on the ground if it is not to become a source of interminable dispute which will increase the cost of administration and undermine railroad support of the scheme.

There are two situations which need correcting — the inadequate return to the owner afforded by the present per diem rate on freight cars better in some ways than those of customary standard construction, such as those of extremely light weight with ABLC brakes, or those equipped with roller bearings; and the inadequate return of present per diem rates on any cars purchased at recent high price levels. In seeking a remedy for the first situation, it will be necessary to agree on the features of new cars for which the railroads generally will be willing to recompense the owners. Such an agreement may be difficult to arrive at.

In considering the second condition, it must not be forgotten that to refrain from the market when prices are high is one of the time-honored measures by which prices are corrected in a free enterprise system. To attempt to set up a system of per diem, the purpose of which is to encourage free buying in spite of price, may meet determined opposition on the part of those who believe prices are too high; they will not wish to recompense another railroad for buying what they will not buy for themselves.

Possibilities for a successful graduated scale of per diem rates would, therefore, seem to rest upon (a) an agreement as to features of new cars which command premium price, the values of which are universally recognized, and (b) a scale of prices paid for freight cars against which there will be little or no opposition on the part of per-diem-paying roads, particularly terminal roads and short lines. Such a scale of per diem rates might be established by periods within which the cars are built. This would be simple to administer.

The Passenger-Car Dilemma

As the passenger-car rebuilding got under way following the close of World War II, the trend toward variety in passenger-car arrangement and decorations, which began during the late 1930's, reached the point of absurdity such that nearly every car was tailor-made. This increased prices to the railroads and did not benefit the car builders. That is essentially the situation as it has existed so far during the postwar period. While extremes of style in lounges and diners occasionally appear among recent car deliveries, there is evidence of some stabilization in interior arrangements, particularly among sleeping cars. Decorations have become no less attractive, but repetition is becoming somewhat more frequent.

The builders are not encouraging tailor-made interior designs. While there is considerable variety in combinations of sleeping rooms, those turned out by each builder are becoming combinations of standard roomette and bedroom units. This is a type of standardization which would seem to offer adequate service to the public until such time as completely new and superior arrangements are developed.

While production economy requires standardization which permits repetition of standardized structural units, railway passenger service must also retain the element of style which played a large part in the new lease on life it received in the 1930's. There is need for sensible combinations of these two apparently opposite factors.

Engine Terminals —Old and New

The old methods of doing running repair work the hard way can be eliminated by investment in up-to-date tools

In order to evaluate possible reduction in operating costs at engine terminals by the introduction of modern methods, it is first desirable to recall the previous inadequate handling. This should not be too difficult, as unfortunately all too many terminals are still awaiting modernization.

Formerly, the procedure was uniform. The locomotive would go over the ash pit, then to the inspection pit (sometimes). Then, if an engine wiper was available, he would carefully go over the jacket and cab and clean them up. Of course, it then looked more presentable! Then into the roundhouse. If it was necessary to drop a pair of wheels, the engine was spotted over the drop pit jack. The tension was taken off of the springs by pure manhandling and blocks. Then the binder had to be removed. Sometimes the nuts on the pedestal binder bolts could be removed by a wrench and a maul. If not, then the bolt could be cut off with a cold cutter and a maul. Somewhat later this was simplified by cutting the bolt off with a cutting torch. Either method required new bolts and nuts when re-assembly took place.

Good pit lighting helps inspection work

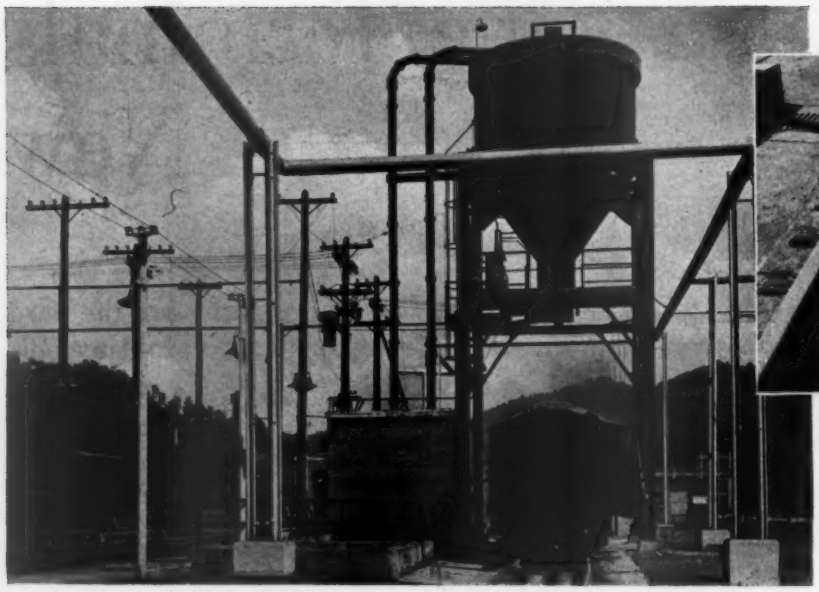
Then the drop pit jack was maneuvered into place after the cover had been laboriously removed. Sometimes it had a telescopic ram, more often, not. The jack had to be located so that the saddle was exactly central, and after the pair of wheels had been lifted, in as near balance as possible, and lowered, the jack was barred over to the release track and everyone stood askance and ready while the pair of wheels was lifted, and after the "falsies" had been put in place, everyone heaved a sigh of relief when it was on a pair of fixed tracks. If it was a form period, the rods were wedged off slowly until they dropped. Previously, of course, they had introduced a special crosshead pin into the crosshead with a wedge and a strong man who beat on it and, with a fire under the neck of the crosshead, it would be eventually parted. Then the front cylinder heads would be removed after someone had performed miracles with an offset socket wrench (a gooseneck). The piston and rod would be jarred forward until the piston was clear and dropped. Then all the parts would be loaded on a series of four-wheel wagons and hauled by a gang over to the machine shop, where they would be lifted off at appropriate spots by a hand chain hoist. If they required cleaning, they would visit the cleaning vats enroute, still being placed in the cleaning pans by a hand chain hoist by individual units, and removed in the same manner.

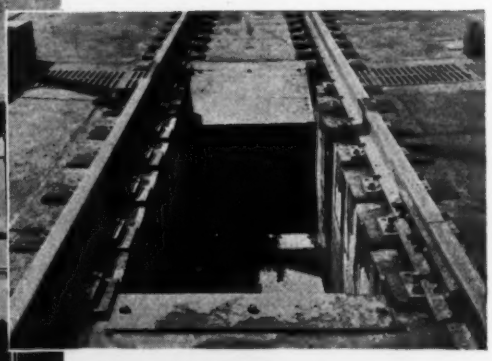
If the air pump, smoke box front, etc. required removal, it was necessary to set up a tripod and hand chain hoist and get them down as well as possible. The superheater units would be jerked out with a chain hoist and handled by a multitude of men after the crushed nuts had been removed with a heavy socket wrench and pin lever or all too frequently burned off. The cab fittings would be removed by S-wrenches ground to special forms and by crude heavy socket wrenches.

When the engine truck had to be removed or the tension taken off the spring rigging for repairs or adjustment, ball bearing screw jacks were used usually with six men, three on each jack.

Removal of caps on flexible bolts was performed with a gooseneck wrench or by a heavy air motor requiring three men and a six foot pipe extension on the dead handle.

Drilling and tapping was performed by a heavy piston type air motor which was by its nature unbalanced and fatigue-producing. Tell-tale hole drilling was





Hydraulic ash handling plants, such as the one shown in these two illustrations, have the advantage of simplicity of operation, the loading of all cinders on one track and in the process of moving the ashes from the pit to car there is very little dust

done with the same type of motor which had limited speed. Consequently drills were broken and it was a punishing job.

Crossheads and springs were swung into place on long chains by several men on account of overhead integral interference on the locomotive.

When the engine was to be despatched the grease monkey would go over each grease opening, drive sticks in and screw down the cap until the cavity was filled. The filling of the sight lubricator was slow, requiring heated cylinder oil of the right temperature, draining out, testing, etc.

In the machine shop, all heavy parts, including rods, crossheads, rod bushings, were lifted by the old-fashioned chain hoist both on and off machines and on and off racks, etc. Rod bushings were manipulated into a heavy engine lathe horizontally until they were chucked with a large heavy overhang, bored in one operation, faced and chamfered in another, turned in another and finally cut off. Rods and motion work were inspected by covering with carbon oil, whiting, and hammered incessantly to detect cracks which might cause potential failure.

Grease cellars were an art in themselves with the forming press, shaping, screen application, etc.

Welding as required was performed by connecting to a tap from a constant-potential set from which, due to the various operations, it was practically impossible to secure the correct amperage, and bare wire electrodes were the accepted practice.

Application of bearing metals was accomplished by melting in a round pot, in a crude furnace, the temperature being estimated by pure guess.

Coaling, sanding and water facilities usually consisted of a wooden tipple with no facilities for thawing coal, crude discharging mechanism: sand was unloaded from the car by hand, heated by a coal stove, elevated by a homemade mechanism and discharged through homemade sprouts, all too frequently, both penstocks and other facilities were located as to require excessive locomotive handling.

Pits were all too frequently too shallow, improperly drained, with no permanent lighting facilities. Roundhouse doors were hand swung, hard to keep properly fitted, making it almost impossible to heat the roundhouse.

Auxiliary equipment for proper operation necessarily included the power plant. Boilers were frequently outmoded and of insufficient capacity, hand fired. This resulted in improper steam pressure for blowers, laundry, air compressor, resulting in excessive time required for blowing, cleaning and also lack of proper air pressure for the operation of tools, etc. The latter situation was sometimes aggravated by too small a compressor. Frequently there was no feedwater heater and in addition, it was necessary to use coal passers to bring coal into the boiler room. Wash and fill pumps would frequently be too small and would not develop sufficient pressure.

Turntables, as the length of power increased were too short and consequently proper balance would not be secured resulting in excessive wear on driving mechanism, which was usually slow, and consequent slow-up on all operations resulting in dispatching delay at a busy terminal.

Contrast With a Modern Engine Terminal

After the locomotive leaves the ashpit it proceeds to a modern laundry, where combined steam, water and a cleaning solution in a suitable gun remove all accumulated grime, grit, dirt, ashes, etc. quickly and positively. This serves two purposes, viz. elimination of abrasive action on all moving parts, including pins and bushings, with subsequent longer life and also permits complete and adequate visual inspection of all parts, thus detecting all worn or defective parts that require repairs or renewal.

Now, in the round house when it is desired to drop wheels, after being spotted on a modern drop table, the spring tension is either relieved by judicious use of the table or a powerful small hydraulic jack, which can be operated from the floor, is used. To remove the pedestal binder bolts a powerful impact wrench is used, which, without any effort on the part of the operator takes all of the nuts off in a few minutes, thus

conserving nuts, bolts, and most important, the man.

When the wheels are ready to drop, the operator standing outside with a push button, picks up the wheels, properly supported and blocked on the table, lowers them, and traverses the truck to the release track by motor-driven truck wheels. The top over the pit at the release track is raised by a motor-driven lifting device, again only requiring the use of a push-button. The drop table top is now raised into place, leveled and held with properly designed locks, and the wheels removed safely and quickly to the release track. The reverse operation is just as simple.

To remove the rods a wrench of correct material and proper striking pad is used, eliminating slippage. In some instances it is possible to use a special socket and an impact wrench, which is still more desirable. The rods are lifted off by a shop crane truck especially designed for roundhouse operation with ample capacity, narrow width and small turning radius, loaded into a jig on a ball bearing trailer of extra length and hauled to the cleaning vat, where the entire jig is lifted by a suitable electric hoist, immersed and removed later by a special apparatus which automatically closes the tops as the jig is immersed, and opens them when ready to remove.

To part the piston and crosshead, a hydraulic unit is used which eliminates the necessity of mauling and heating, requiring only the stroke of a short pumping lever.

Removing and applying springs, crossheads, pistons and rods, is done by a hydraulically-operated floor lift portable jack with a jib which can be placed exactly where required with no interference as the lifting point is below the overhead interference.

Cylinder head nuts, valve head nuts, etc. are all removed with an impact wrench. Where the location, on account of interference, prevents the use of the straight impact wrench, an angle type is used where the amount of usage justifies, and in other cases a universal joint which is operated in conjunction with the straight wrench is satisfactory.

All other parts requiring attention in the machine shop are loaded on ball-bearing trailers and hauled by the truck to the appropriate spot in the machine shop and removed by small electric hoists.

Air pumps, smoke box fronts, etc. are removed by the crane truck which has a telescopic boom adjustable for any height and capable of removing any item required and either depositing adjacent to the engine or conveying to a designated spot. Meanwhile, the superheater units which have to be removed have the nuts loosened by the impact wrench with appropriate entension alloy steel sockets and the units removed by the crane truck.

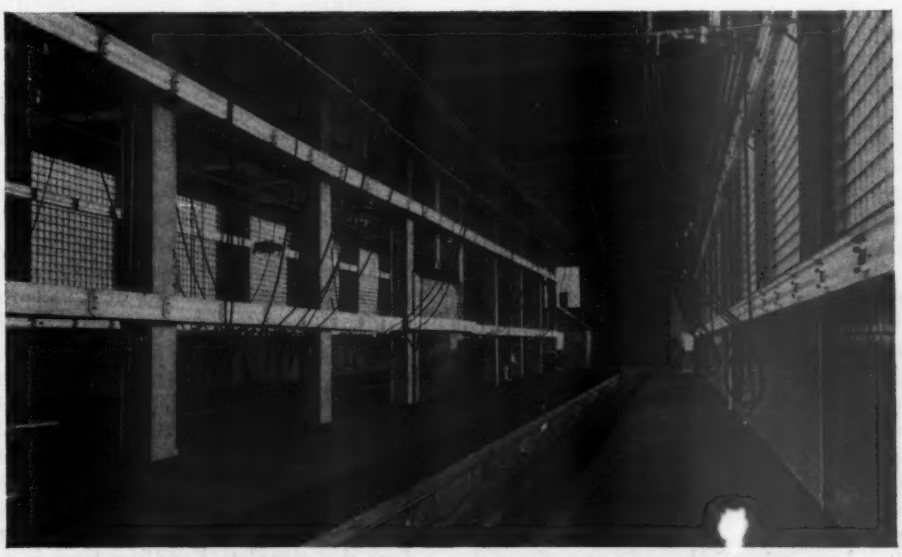
In the cab, sets of modern alloy wrenches with thin strong sockets and special pointed wrenches, with offset boxsocket, ratchet wrenches allow the operator to remove any appurtenance easily and quickly.

In making engine truck repairs or in case of any necessity for jacking up the front or back end of either the engine or tender, portable pneumatic jacks are now wheeled into place, blocked, and in a matter of minutes the jacking is completed by simply operating a valve. This obtains on either raising or lowering.

Removal of caps on flexible bolts is performed by the same impact wrench referred to previously without fatigue on the operator. In fact the impact wrench is invaluable and indispensable on all types of operations.

Proper lubricating methods have advanced immeasurably. The most modern type is the lubritorium, which consists of a separate building where one or more locomotives are spotted and permanent installations on the walls strategically located provide through suitable hose all types of grease and oil required. The desirability is obvious. However, since a separate building and installation is required, the use of this type is as yet limited. But greasing of all locomotives has been expedited by use of various types of lubrication pneumatic guns, including a pneumatic type for hard greases, one for soft greases, and one for oils which permit quick complete, adequate greasing of the entire locomotive in a minimum of time with very little manual labor required.

In the machine shop all heavy parts are lifted on



Interior of lubrication section of a modern terminal

Modern terminal servicing facilities must be well adapted to night operations

and off the machines by small electric hoists. Rod and similar bushings are handled on vertical turret lathes in a vertical position which permits immediate chucking with a universal chuck with no unbalance and simultaneous boring, facing and chamfering, and turning by the turret and side heads and a sufficient speed to use carbide tools.

All rods, motion work, piston rods, etc., are inspected by a magnetic testing machine with the use of metallic powder that definitely indicates visually any cracks, no matter how minute, which positively removes from service all parts that would cause failure.

Engines are lighted off with modern vacuum-type oil lighters which eliminate excessive smoke and also distribute the lighting flame at any point desired so as to have even firing.

Tires are removed and applied by modern vacuum-type oil torch with appropriate rings ensuring proper flame and even heating.

Modern rotary type motors are used for all drilling and tapping operations, this type being lighter, properly balanced and of correct speeds. This particularly applies to telltale and similar drilling.

Welding is performed by portable welding units of sufficient capacity. These allow exact amperage required on any operation and also the use of either straight or reverse polarity coated electrodes. This ensures correct welding procedure and consequently proper welds. Since the slag produced by the coated rods has to be removed after each pass, light pneumatic weld chippers are used to remove it.

Modern coaling facilities are constructed to store an ample number of cars in a building with sufficient heating facility to thaw out frozen coal thoroughly and the tipple is weather proof so that the coal will remain dry until it is discharged into the tender with a minimum of dust and a minimum of time.

Sanding facilities remove the sand quickly onto conveyors which move the sand through a thoroughly heated chamber, where it is dried quickly to a heated storage with a discharge that will act through a wide angle, placing the sand in any kind of opening, due to its flexibility, and with very little loss of time.

Penstocks are modern, protected from freezing, also flexible, and located strategically.

Pits are of proper depth, adequately paved, suitably drained, and with protected sub-wall lighting that permits efficient handling of all parts. Roundhouse doors are of the roller type, motor driven, reasonably airtight, and permit quick entrance and egress, also retaining heat, so that workmen have a comfortable temperature in which to perform their work. Glass block construction and electric lighting facilities allow either artificial or daylight correctly to light the house eliminating the necessity of spotlights from extension cords thus preventing accidents and increasing the tempo of the performance.

Stoker or oil fired boilers of modern design, with adequate feedwater heaters produce steam in adequate quantities and at correct pressure economically. Where coal is used, it is dropped by gravity into feed hoppers or elevated by conveyors from the pit to the hoppers.

Wash and fill pumps, giving ample flow at designated pressure, expedite laundry and filling operations.

Air compressors of fractional unloading type, greater efficiency deliver air in adequate volume and pressure for all purposes.

Turntables of correct length and design handle all power quickly, in true balance and increased speed.

Ash pits permit quick removal of all ashes and automatic removal and loading reduce sharply time required.

It can be readily seen that a locomotive arriving on the ash pit is progressed steadily and efficiently through all operations of cleaning, repairs, and servicing being placed on ready tracks which are designed with sufficient reverse crossovers for quick selection and release of any type of power and therefore the complete handling time is reduced sharply, resulting in a very substantial savings.

Economies in Back Shop Operations

A general discussion of the several factors that are involved in the changing picture of steam locomotive repairs

THERE remain, on the railroads of this country, approximately 31,750 steam locomotives and about 8 per cent of this inventory is in or awaiting shop for repairs at all times. Every time one of these locomotives goes through the shop for repairs an expenditure of from 5 to 15 or even 20 thousand dollars may be made on it to put it in first-class condition and to restore the two or three hundred thousand miles of potential road service that was run out before the unit came to the shop.

The cost of locomotive repairs represents a major part of the cost of operating a locomotive and the cost of repairs, whether figured on a unit basis or a per-mile basis, is increasing rapidly under present conditions because of great increases in the cost of labor, in the cost of the materials that are used in repair work and because of at least two other factors—the decreased productivity of labor and the growing obsolescence of the shops and the shop equipment with which steam locomotive repair work is done. In spite of the fact that many millions of dollars have been spent by the railroads on shop equipment year after year it is a fact that many more millions have been spent on the maintenance of the facilities in the repair shops than have been spent in adding new units to the shop with a view to the systematic replacement of shop units that have outlived their usefulness and have become an economic burden on the owning road.

And so, today, the railroads find themselves in a position of being faced with mounting maintenance costs on a major portion of their motive power inventory as a result of having gone along for years without any definite plan for modernization of steam repair facilities such as would assure their repair work being done at minimum cost. Moreover, there seems to be little disposition on the part of those who make mechanical department policies to consider the fact that 78 per cent of the motive power inventory presents a maintenance problem of sufficient importance from a cost standpoint to warrant that it be given equal attention to that which is directed toward the solution of problems relating to the installation of modern repair facilities for Diesel-electric locomotives.

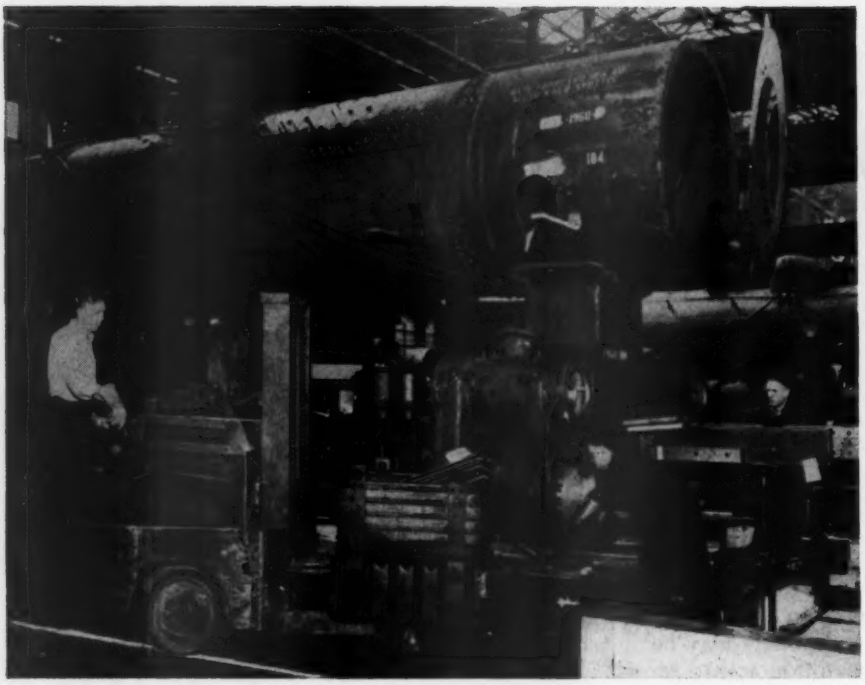
No doubt part of this attitude is due to the assumption that the steam locomotive, on most roads at least, will be replaced with the Diesel-electric at as rapid a rate as has been the case in the immediate post-war years. If we may assume for sake of discussion that all steam power will eventually be displaced by Diesel-electric then it may be worth while to explore the available statistics to determine the period over which this displacement might be expected to take place.

Before the war, when the installation of Diesels was getting under way the ratio of replacement was from 1.5 to 2.5 steam locomotives replaced by 1 Diesel. In this light, the figures for three years are interesting, for on April 1, 1947 there were 36,625 steam units and 4,811 Diesel-electric units. A year later, in 1948 there were 34,421 steam units and 6,319 Diesel-electric units. This was an increase of 1,508 Diesels against a decrease of 2,204 steam units in one year and the ratio was 1.44 to 1. In the year ended April 1, 1949 the number of Diesel units increased by 2,592 to a total of 8,911 and the number of steam units decreased 2,669 to a total of 31,752 but the replacement ratio dropped to 1.06 to 1.

The replacement ratio has been dropping all the time and the only reason for injecting it into this discussion of shop facilities is to drive home the fact that even if replacement of steam by Diesel continues at the current rate it would still be from 10 to 20 years before the last steam locomotive disappears from the rails. In the meantime what are the railroads going to do about steam locomotive repair facilities—pursue a policy of ignoring their importance in the matter of influence on maintenance costs and do nothing about their rehabilitation or adopt a more realistic policy of exploring the possibility of holding under control steam locomotive maintenance costs by the elimination of practices and facilities that are running up the cost and investing intelligently in new facilities that can be amortized in relatively short periods because of their ability to contribute substantially to reductions in unit costs of doing repair work.

Thorough Studies Are Needed

There are some basic assumptions that may be made with respect to the steam repair shops on almost any road. These are that, having been built and equipped at some time in the past when there were a larger number of older locomotives to be repaired, the chances are that the shop layout is spread out over a greater area than is consistent with present day needs; that there still may be repair work being done at several points on a road that could well be concentrated



The variety of models available in the power type truck offer a solution to the problem of moving materials about the shop and applying it to locomotives in erecting work

at a central shop; that within any shop building there may be obsolete units of shop equipment which should be scrapped because of their inability to produce economically and that by the scrapping of these units a considerable amount of floor space might be released that could be used in the more efficient rearrangement of several departments in a single shop building.

No decision as to what to do about shop facilities can possibly be made without accurate facts concerning the use to which the facilities are now being put. The shop engineering department of most large industrial plants would not make any attempt to effect a rearrangement of production facilities without making the most careful studies of the character of the work in a plant or a department, the volume of the various kinds of work and the flow of the work through a department. In this manner an analysis can be made which will show the extent to which the work of a given department is being handicapped by machining or parts handling facilities that are definitely unable to meet the requirements of an overall schedule.

How Economies May Be Effected

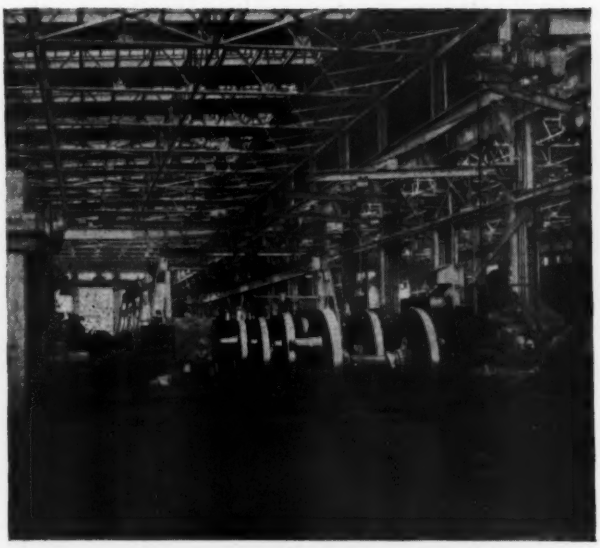
Probably the most difficult problem in connection with any rearrangement of repair facilities that are used for the heavy maintenance of steam power will be to make such reductions and alterations of these facilities as will enable a road to keep pace with the changing volume of work as the number of units in the inventory of locomotives decreases. It is of the utmost importance, for example, that management recognize immediately the potentialities for increases in maintenance costs as a result of the continued use of obsolete and inefficient repair facilities at outlying points when the volume of work in the major departments of a system shop is such that there is excess capacity available. In many cases the only excuse for doing locomotive repair work at any other point than at a system shop was the inability of the main shop to meet the demand for many of the parts needed. When that condition ceases to exist definite savings may be effected by the elimination of the older facilities, of whatever nature, at points other than the central shop.

Economies are of a definite nature when unnecessary shops or equipment are completely eliminated for as long as a unit of shop equipment remains in place there is always the temptation to make odd-time use of it and in order to make such use of it at any time there are certain fixed charges such as taxes, insurance and maintenance that always accumulate against it. It costs money to allow a piece of shop equipment to remain on railroad property and under present-day conditions it is important to get rid of it when the decision has been made that it is no longer of any real use.

Material Handling Equipment

Most direct savings in shop work are made as a result of the elimination of man-hours of labor and in the back shop this is accomplished by the constant study of the individual shop operations with that as an objective. In the steam locomotive back shop better than 60 to 65 per cent of all the man hours in the shop are in the boiler, erecting and machine shop and of these departments the boiler and erecting shops present the most difficult problems of labor saving because of the nature of the work. In the erecting shop particularly, with the exception of the work on the locomotive bed and its connections, the major job of that department is in applying the sub-assemblies and other parts of the locomotive in the least possible time. Here then, the major considerations in saving man hours are the equipment with which the parts are delivered to the department, the facilities with which the parts are applied to the locomotive and the tools which are used in finishing the job of application.

Mobile material handling equipment in combination with lift or hoisting equipment is just now com-



The wheel department requires machining operations on which modern tools can effect savings

ing into its own as a result of the thorough studies that have been made by production departments in other industries. In the relatively short space of a few years since the end of the war we have seen the power shop truck cease to be either a simple means of transporting a heavy part from some point in the shop to the erecting floor or possibly a combination crane-platform truck and have watched it develop into an extremely flexible machine that is capable of handling heavy loads and not only delivering those loads to the point of use but also of assisting in the actual application of parts in position on the locomotive. The potentialities of many of the recently-developed models of mobile material handling equipment offer real possibilities for savings as a result of the elimination of hours of labor in all departments of locomotive repair shops.

It is in the machine shop, however, where there are a multitude of real possibilities for savings and here again it is primarily a question of the elimination of labor hours. After the production studies previously referred to have been made so that it is possible to know in detail the current operating history of every machine tool unit in the shop it becomes necessary for the railroad shop engineer to recognize a factor that seems to have been overlooked most of the time in this industry while it is watched with extreme care in most other machine tool using industries—that is the machine load factor. Machine tools are expensive pieces of equipment and because they do represent, as units, a substantial investment they should be kept busy. There is no reason why, as far as the major machine tool units of a shop are concerned, almost every machine in the shop should not be performing some productive function 80 to 90 per cent of the time and yet it might be a surprise to know that in many railroad shops the machine load factor for entire shops and many major departments actually is as low as 30 to 40 per cent.

Abundance of Capacity

The principle reason for this is that in most shops there is an abundance of machine "capacity" in the form of idle and quite often obsolete units and the presence of this unused capacity is not brought into the spotlight until a study is made that requires an analysis of the hour-by-hour use of every machine. By arbitrarily eliminating many of these older units and transferring the work that is sometimes done on them to the best of machine tools capable of performing a given class of work the ability of a tool unit that was considered modern by the shop management is forcefully brought out and the real shortcomings of some of the "good enough" machines may prove to be sufficiently glaring to dictate a decision to replace these machines with really modern tools that can do more work than a half dozen of the obsolete models.

Particularly in production groups such as in turret lathe work it has been found that three or four modern machines with the proper tooling equipment can replace twice as many machine units that have been on the shop equipment roster for 20 or more years.

The machine shop department of a modern locomotive back shop

In the post-war period the development of automatic cycle and semi-automatic machines has opened up an entire new field for economies in machining operations. Originally the automatic machines were used mostly on small parts machining but with the advent of machine tools on which the operational functions can be pre-set it has been found advantageous and economical to perform heavy machining operations such as steel wheels. This type of machining has been done only on a limited scale in railroad shop work but enough has been done to indicate the potentialities in machines of this type. One of the definite advantages of this type of automatic-cycle machining is that once the job is set up it is not possible to alter the floor-to-floor time for a complete operation. This takes the control of the production time entirely out of the operator's hands.

Another development in the semi-automatic machining is the tracer attachments that are applied to such types of machine tools as the engine lathe and the milling machine. With these attachments on modern machine tools with modern tooling equipment many hours of total production time and many dollars of production cost are saved by the simple expedient of providing a series of templates for a variety of locomotive parts that are required in the normal course of repair operations.

Another important source of economies in machining operations is related to that portion of the floor-to-floor time known as the handling and set-up time. While it is true that a large part of the machining operations performed in railroad shops are of a type that do not lend themselves to production in quantities it is also true that if an analysis is made of floor-to-floor time on the majority of machine shop jobs on locomotive parts it will be a surprise to find that such a small part of the overall time is actually metal cutting time and that such a large part is handling and set-up time. It may also be found that a substantial portion of the wasted time is due primarily to the lack of individual crane and hoist facilities that could serve individual machine tools.

Conclusion

In as much as a large part of the steam locomotive heavy repair facilities in existence today were built several years ago it is reasonable to expect that with a changing volume of work there are many units of shops and shop equipment that are not needed or suited to the character and volume of work that must be done today. Only a series of accurate surveys of the use of these facilities will reveal the extent to which they are needed. If they are not needed it is in the interest of economy to eliminate them and thereby effect a reduction of the fixed charges incident to their retention as part of the physical property.

Direct economies are effected as a result of the elimination of man-hours of labor. This is best done by transferring work to the most efficient production units, whether they be machine tools or other types of labor-saving devices, and eliminating the obsolete equipment. This not only eliminates the man-hours of labor expended on the operation of the obsolete equipment but tends also to contribute further to a reduction in fixed charges. Additional economies are effected by replacing several obsolete units with modern high capacity tools; by installing, where the opportunity presents itself, automatic cycle or the tracer type of machine tools in order to take advantage of low cost repetitive production on locomotive parts that are needed in the greatest quantity; by adding modern tooling equipment to high capacity units further to increase its capacity and finally by a study of overall time with a view to reducing the machining and set up time on the most productive of modern tool units.

It is in the manufacturing of locomotive parts that are produced in large quantities and in groups of parts of identical design that substantial savings can be effected by the use of some of the newer designs of machine tools which automatically machine a piece from a master or a template

EDITORIALS

What To Do About Future Costs

In this issue of *Railway Mechanical Engineer* there has been included a group of articles that encompass the activities of the mechanical department—motive power and car problems related to the utilization of equipment and the servicing and maintenance of thousands of cars and locomotives.

Probably the most significant thing that has happened in this industry in the past ten years has been the change in the character of motive power. The rapid adoption of the Diesel-electric locomotive has had a profound effect on all phases of mechanical department activities. It has not only brought with it an entire new category of servicing and maintenance problems but, because of the displacement of so many hundreds of steam locomotives by the Diesel, the question of the logical course to take with respect to engine terminals and steam locomotive back shops is one that requires exhaustive study and real planning in order that the many thousands of units of steam power that will be an important part of the motive power inventory for several years to come may be adequately and economically maintained. It is not possible just to ignore them.

It is with the idea of treating upon as many phases of the equipment maintenance problem as possible that there has been discussed the matter of Diesel facilities, from both electrical and mechanical standpoints; the trend in motive power and the significance of the changes taking place; car repair shops and the potentialities of modern facilities; engine terminal operations and, finally, the situation with respect to freight car supply.

In presenting these subjects it is hoped that they may serve not only as a guide to the solution of many of the new departmental problems but may help crystallize decisions pertaining to the attitude toward the older problems as well. Regardless of the best efforts that can be made to control the expense of performing the functions of the mechanical department, the costs, in the future, are going to be high and it is of the utmost importance that only those facilities in the way of shops, terminals and the tools with which work is performed that can be classed as modern and efficient be continued, or installed, in service. There is definitely no place for many of the obsolete facilities that have been carried along through the years in today's maintenance picture for at best they not only require more man-hours to do a job than is necessary but, by slowing up the job of repairing equipment, they keep expensive and revenue-producing cars and locomotives out of service for a greater length of time.

"Shop on Wheels" Built by North Western

One of the things which characterizes the modern Diesel shop, particularly as compared with a typical steam locomotive repair shop, is its compactness, with the consequent reduction in the distances that men and materials must move; space is available where it is needed for such operations as power truck movements and for parts replacement or overhaul, but none is wasted and permitted to perform no other task than to increase needlessly the distances over which men and materials must travel. A second feature of the modern Diesel shop, closely allied with the first, is the careful attention given to material handling. This applies not only to reducing the distance of travel but as well to increasing the actual efficiency of the movement, and to minimizing the number of times parts and materials must be handled. These desirable characteristics are attained to a high degree in the operation of the C. & N. W. Diesel shop described in this issue.

Special conveyances have been built or purchased to handle a wide variety of objects ranging from large Diesel engines to small filters. All serve the same purpose—to move things from one point to another in the least possible time and at the least possible cost. The main difference caused by the size of the object to be handled is in the ratio between the numbers of the parts moved to the numbers of conveyances required, e.g., four dollies are required for one Diesel engine while several dozen filters are carried in one cart. Some of the devices are employed to store parts as well as to move them, thus eliminating one handling operation. One such example is the assembly comprising the Diesel engine head, liner, piston, connecting rod and gasket which is assembled at one point, placed in groups of four in a storage rack mounted on wheels, and rolled to the point of application for storage until needed. Crane systems, to, have been installed in ade-

quate quantities to contribute their share toward efficient material handling. The main parts reconditioning room, for example, has three overhead crane systems, each with two 1,000-lb. hoists, and a 30-ton traveling crane, with a 5-ton auxiliary hoist, serves two of the tracks in the main bay.

What should be of special interest in this shop to all railroad men is that many, if not most, of the procedures for transporting parts and materials can be used in almost any shop. It is not necessary to have a large enough fleet of Diesel locomotives to justify a similar shop, nor the cash with which to build it. All it takes is a little thought to adapt similar devices for use in a shop of any size, sufficient ingenuity to build some of the conveyances and a comparatively small cash outlay to purchase others.

What Would You Have Done?

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Two Problems in Freight Car Use

The number of specific problems which arise in connection with the daily use of freight cars is legion. In accordance with customary practice of long standing, the A.A.R. Mechanical Division serves as a clearing house where information regarding abuse of equipment is concentrated and necessary corrective action recommended. By periodic and often repeated hammering away at undesirable practices, the division has contributed greatly over the years to improved equipment standards and better service to shippers, but for maximum effectiveness, this work requires more support from individual railroads than projects of this nature have received in the past.

Take, for example, freight-car floors which have been damaged by faulty loading and unloading practices with heavy mechanical equipment. This subject has been called to the attention of railroads and shippers in the past and, no later than April 15 this year, was discussed in another Mechanical Division circular letter which deserves widespread attention and appropriate action.

According to this letter, the use of lift trucks for loading and unloading of freight cars is steadily increasing. Lift trucks now in use weigh from 6,500 lb. to 23,000 lb. and will carry loads up to 18,000 lb. Under these conditions, it is possible to get loads upwards of 20,000 lb. on one floor board between supports. Concentrated loads on a car floor should not greatly exceed 500 lb. per sq. in., therefore, with the combined weight of lift trucks and load, it is necessary that temporary steel plates of suitable size be used to distribute the weight of wheel loads and prevent damage to car floors.

In order to conserve equipment and avoid frequent shopping for renewal of floor boards, delays to trains enroute on account of transfer of lading, and the possibility of derailment due to lading falling through car floors, the following corrective measures are recommended:

"A careful inspection should be made of all cars furnished for loading and cars selected should have flooring and floor supports adequate to carry lift trucks if used; also, adequate to carry lading to destination. To accomplish this, it will be necessary for car forces to become familiar with loading practices and commodities shipped in their district and for which their railroad is supplying cars.

"Some of the auto cars and older cars were constructed with only one floor stringer between the center sill and the side sill, which have proven inadequate, and should not be furnished for loading heavy commodities. When such cars are being rebuilt or receive general heavy repairs, consideration should be given to the application of additional floor stringers.

"When cars are on repair tracks, careful inspection should be made of floor stringers including end attachments to crossbearers and bolsters; also, to fillers between center sill and floor to make sure that proper support is provided for floor boards. Individual floor boards found broken should be promptly renewed to avoid breakage of additional boards and loss of car usage on account of shopping for renewal of the complete floor."

Similarly, the Mechanical Division issued a circular letter over a year ago recommending the application of hold-down clips (Plate 803-A) to steel gondola cars, to avoid insofar as possible giving shippers any excuse for burning holes in car bodies to accommodate tie-down bands, rods and wire used in securing loads. This matter was again referred to at some length in a circular letter, dated April 18, because shippers still resort to the practice and, in fact, make more holes and larger holes than actually required.

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Admittedly, the two relatively minor details mentioned are but a small part of aggregate freight car maintenance and performance. A thorough job of clearing up these details, one at a time, however, as attention is called to them, will soon make a noticeable reduction in repair costs as well as provide more satisfactory equipment for shippers.

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quate quantities to contribute their share toward efficient material handling. The main parts reconditioning room, for example, has three overhead crane systems, each with two 1,000-lb. hoists, and a 30-ton traveling crane, with a 5-ton auxiliary hoist, serves two of the tracks in the main bay.

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ELECTRICAL SECTION

Electrical Equipment For the Diesel Service Shop*

The Chicago & North Western shop affords an example of the electrical requirements of a shop in which no heavy electrical repairs are made

By W. C. Chapman†

THE Chicago and North Western Railway Company, realizing the necessity for providing efficient facilities for the servicing and repair of Diesel locomotives, has built at its Chicago shops the most modern shop of its kind in the country. The building is approximately 142 ft. by 407 ft. with a cubical content of 1,928,000 cu. ft.

This entire facility is electrically operated. The current is furnished from an existing substation and transmitted to this new Diesel building over a 2,300 volt, 3-phase, 60-cycle line to three 150 kva. transformers located at the west end of the new building. The transformers reduce the voltage to 440 for the operation of all motors of ½ horsepower and larger.

The current enters the building at the electrical service room where all power feeders radiate to power distribution panels located throughout the building.

The 120-volt current for lighting is obtained by the use of 8 dry-type transformers varying in size from 37½ to 75 kva. which are connected to the 440-volt feeder lines, and located at the various load centers.

The electrical installation has been planned to give the utmost safety to the persons using the various facilities. The distribution panels both for power and lighting are of the circuit breaker type and, with the exception of the portable tools, cranes, welders and the large crane trolley feeders, all wiring is enclosed in conduit. Wherever portable tools and cranes are fed with portable cables, the ground wire is carried through to the apparatus to protect the operator.

The large 30-ton crane over the high bay heavy repair section is so arranged that it can be operated by an operator in the crane cab, or from the floor level by push buttons attached to a control suspended from the cab.

The 5-ton crane in the engine overhaul room and the 2-ton crane in the parts cleaning room are operated from the floor by push buttons and use the duct system instead of open trolley wires.

The 100-ton Whiting drop pit table serves all tracks across the entire building and is also operated by push buttons from the working floor level, subfloor level or from inside the pit. On the working floor level and subfloor level, there are five control station receptacles and indicator light panels. The control receptacles are used to plug in the portable control cable (with push buttons attached) so that the operator can operate the table from the best position. The indicator lights indicate when the table is lined up for the desired track.

Power receptacles are installed at various locations so that electric welders, chargers and Magnaflux machines can be used.

The large roller type doors of each track at each end of the building are electrically operated with push button control. They can also be operated by hand in case of power failure.

At the west end of the shop on each of the three service tracks are installed movable bridges electrically operated with push button control. The bridges, when in the lower position, allow locomotives to leave or enter the building. When in the up position, the high level platform is made continuous so that employees can cross between service platforms.

All heating and ventilating fans are electrically operated and controlled by thermostats. The exhaust ventilating fans are so connected that they can be controlled individually and, in the case of emergency, they can all be shut off by a push button station located at each end of the building.

The foreman's office, electricians' shop, pipe fitters'

* Heavy electrical repairs including overhaul and rewinding of traction motors and generators is performed in a section of the steam locomotive shop located near the service shop. The work done in this shop is described in another article in this issue. Included in the other article is also a plan of the service shop described above.

† Chief electrical engineer, Chicago & North Western Railway Co., Chicago.

Interior of the service shop showing the overhead lighting units, the pit lights and the electricians room at the extreme right

shop and tool room are located on the high level platform for efficient operation. The electricians' room contains a voltage stabilizer to keep constant voltage on a circuit for testing automatic train control mechanism. There is also installed a rectifier to enable them to have the necessary direct current for testing relays and oil pump motors. The pipe fitters' shop is equipped with a threading and cutting machine.

Engine overhaul room is equipped with a 5-ton crane, operated by push buttons at floor level, and a small lathe for machine work, as well as air conditioning equipment to provide dust-free air.

To facilitate the work on trucks and under side of the units, work rooms for the electricians and pipe fitters are provided on the lower level.

On the lower level is a battery storage and charging room. This room is equipped with a rectifier and charging receptacles so that batteries, when not in use, can be kept in good condition, ready for service.

The small parts cleaning and filter cleaning room is equipped with a 2-ton electric crane, push-button operated, and the necessary cleaning and washing tanks. The filter cleaning machine is also equipped with a hoist to place the filters in the dryer after they have passed through the washer.

The parts reconditioning room is equipped with six electric hoists so arranged that each pair of hoists will overlap each other, and facilitate the handling of materials. This room is also equipped with grinders, buffing machine, lathe, drill press, boiler tester, and a Magnaflux machine with Magnaglo attachment.

In the sub-basement under the engine overhaul room are located all the electric-driven pumps for condensation return, radiant heating, snow melting, and fire prevention. With the exception of the snow melter pump, they are all automatically operated by floats or pressure switches.

Outside of the building at the east end is a lye vat, with a 10-ton overhead electric crane operated from the ground by push button control.

Diesel fuel oil for fueling the units is received in tank cars and transferred to a 150,000 gal. storage tank, located some 200 ft. to the north of the new service building. The fuel oil is transferred from the tank cars to storage tank and to the units by two 200-g.p.m. pumps, driven by 10-hp. motors operated by push buttons located at the oil pump house and at each outside platform east of the service building where units receive the fuel and sand.

Lube oil is received in tank cars and transferred to a 13,800 gal. heated storage tank located in the pump house. This transfer is accomplished by a 90-g.p.m pump, driven by a 5-hp. motor. Lube oil is transferred from the storage tank to the service platforms inside the new shop by two 50-g.p.m. pumps, driven by 5-hp. motors that are controlled automatically by pressure regulating switches.

The lighting of this new Diesel service building received excellent attention, and is the type of lighting that railroad men have dreamed of for many generations. It is a combination of incandescent and fluorescent lamps with receptacles for extension cords to furnish illumination for places where permanent lighting cannot be directed.

The high bay section is illuminated with 75 high bay porcelain enameled reflectors with 750-watt lamps.

The three service platforms on the high level are illuminated by 56 three-light and 28 two-light enclosed fluorescent fixtures using 40-watt lamps. The fixtures are spaced so that if at any time more illumination should be required, another fixture can be installed between the present fixtures.

The lower level of the three service platforms is illuminated by 168 two-light enclosed fluorescent fixtures of a special angle design that will illuminate the sides of the trucks so that mechanics can do their work

without the use of extension cord lights. The inside of the three pits on this low level is illuminated by 42 pit-lighting units with 100-watt incandescent lamps. Receptacles are furnished every 25 ft. along each pit for use of portable lights and tools when required.

The engine overhaul room requires a very high intensity of light and is illuminated by 16 enclosed units having 500-watt incandescent lamps.

The parts reconditioning room and injector and governor room also require a high intensity of light and are illuminated by 44 enclosed two-light, 40-watt lamp fluorescent fixtures.

The filter and parts cleaning room, store sections and passageways are all well illuminated by the use of enameled steel reflectors, having 100 to 200-watt lamps. The lighting of the material racks in the store sections is accomplished by stock bin fixtures.

The dining room, locker and wash room, and toilets are well illuminated by glass steel and enameled steel reflectors with 100-watt lamps.

In the shower bath room, vapor-proof fixtures are installed. These have 100-watt lamps.

All exits and doorways leading to exits have illuminated exit signs, that comply with the latest regulations. Fire alarm boxes connected to the shop's fire alarm system are installed at each end of the building.

Local shop phones and outside Bell telephones are installed in the foreman's office and storekeeper's office, with extensions to several parts of the building and stores section.

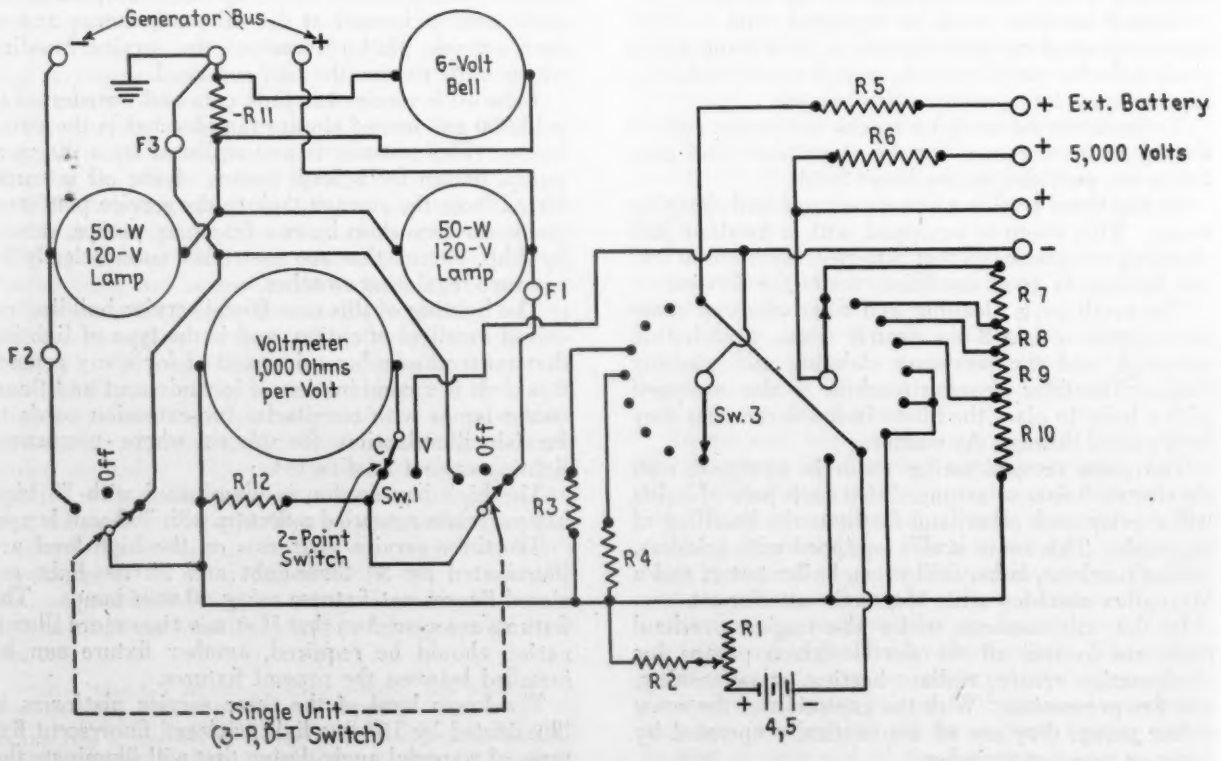
A loudspeaker talk-back system is now being installed both inside and outside of the building. A system of this kind, with the central control in the foreman's office is a great asset in directing the operation of the shop and in directing the movements of units in and out of the building.

Portable Test Set

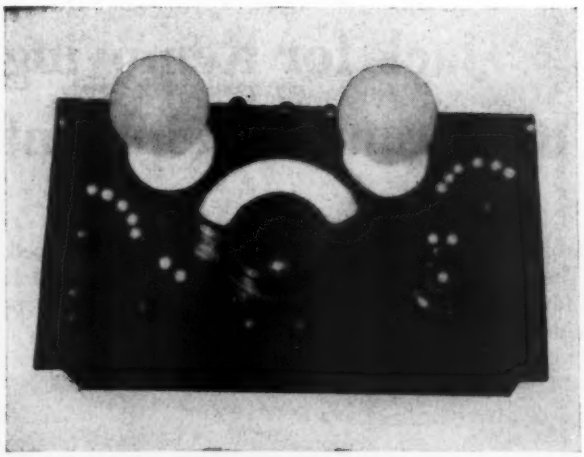
By A. H. Matthews

THE test set shown in the photograph was put together to serve primarily as a portable ground detector, but also for a variety of other purposes. One ground in a passenger car power circuit is only potential trouble, but two are real trouble, and it can be bad.

As a ground tester, the instrument is hooked to the battery charging panel with spring clips. When



Testing set wiring diagram



The set is compact and easily portable

a ground shows up, the amount of current to earth is read. The switch *SWZ* is thrown to one side or the other, and the protective fuses *F1*, *F2*, and *F3* prevent damage to the meter if the current is over 10 amp. With a little experience in its use, it will be found that the amount of current and voltage gives a pretty good indication of the location of the ground. In operation, the terminals *E* and *X* are connected to the generator bus bars or the main switch on the panel, with the three switches in the ground detector circuit in the test set being in the *OFF* position. Both lamps should light equally if the line is clear. One will be bright and the other dim if a ground appears. If the ground is solid or full, the bell will ring. The resistor *R11* allows enough current to flow to operate a standard 6-volt bell with 50-watt lamps. The resistance also cuts down arcing at the bell contacts. Therefore, the bell may be placed at a distance, perhaps even in an office.

For low-voltage testing, the volt-ohm-ampere circuit is used. This provides for low currents from 1 m.a. to 100 m.a. with the shunts *R3* and *R4*, or other shunts can be applied across the posts to obtain any desired current range. The 4½-volt battery is contained in the case.

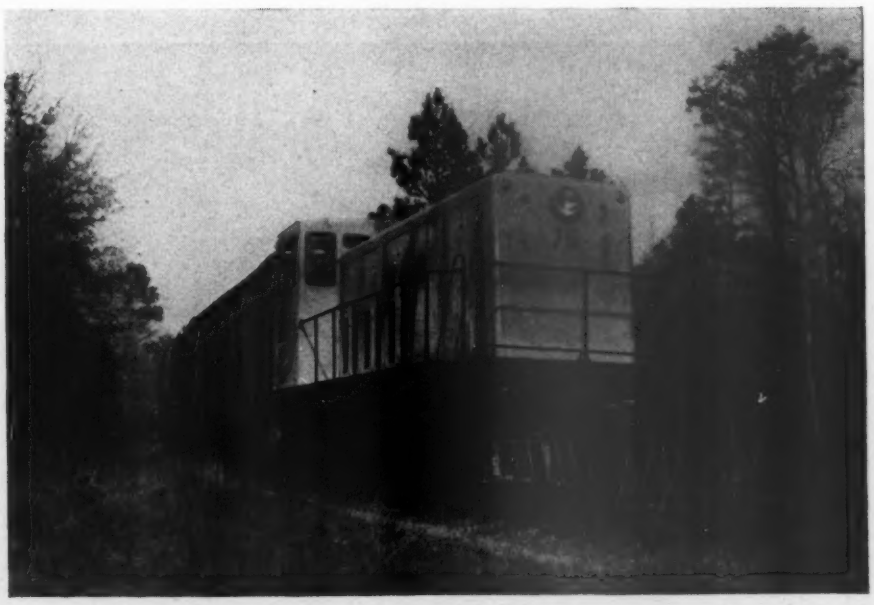
The approximate value of insulation resistance can be found either by means of the low-voltage volt-ohm-ampere test, or very high resistance may be tested by means of the circuit having the external battery in the test circuit. The external battery, high-resistance test is made only after a reading has been obtained on the normal, low-voltage circuit. The actual voltage of the battery depends on the meter scale, if direct readings are wanted. The 5,000-volt post is for testing high voltage d.c., such as used in radio transmitters. The meter has a high-voltage scale up to 5,000 volts.

Only approximate measurements are made with the tester. It does not replace the Megger tester, which should always be used when in doubt.

The meter is a Weston 0-1MA with four scales, providing full-scale readings with 1 m.a., 10 m.a., 100 m.a. and 10 amp. respectively.

The values of the resistors are as follows:

R1 = 2,000-ohm variable
R2 = 3,000-ohm, ½-watt
R3 = 0.33-ohm, 100-m.a.
R4 = 3.6-ohm, 10-m.a.
R5 = 40,000-ohm, ½-watt
R6 = 4-megohm, 4-watt
R7 = 0.75-megohm, 1-watt
R8 = 0.2-megohm, ½-watt
R9 = 40,000-ohm, ½-watt
R10 = 10,000-ohm, ½-watt
R11 = 180-ohm, 10-watt
R12 = 0.0033-ohm, 10-amp.



An Alco-G.E. 70-ton Diesel-electric of the Marianna & Blountstown on part of its run through Calhoun County, Florida —This locomotive was placed in service on October 1, 1947, replacing two steam units—A third steam locomotive was retained as a standby

Jack for Removing Underframe Equipment

In order to remove the larger generators of the present day modern passenger car, means must be provided to maneuver the projection of the generators around various supports. In some cases where there is a double ended drop table, a dolly-type truck on casters is used. The generator is spotted over the drop table with this truck on the table supporting the generator. With all connections and mounting bolts removed, the table is lifted enough for the generator to clear and the car moved enough to drop the table with the generator and truck. With the table down to the wheel track level,—by means of a proper hoist, the defective generator is exchanged for an overhauled one, —placed on the truck on the table, and the table raised. When clearance is proper, the car is moved back and the table lowers the generator in place. Bolts are put in loosely, and the car moved on to avoid congesting the drop table. The connections are then made and the equipment tested in a normal manner. This time over the drop averages fifty minutes, a fraction of the former time.

However, where this system is not practical, an even simpler method can be utilized at a relatively small cost. At the Mott Haven Yards, of the New York Central, a portable lift was designed to change generators on the repair track. The area under the track, where this work was done, was planked over. The lifter has a scissor jack at all four corners. Each jack is operated individually, and the arrangement allows the generator to be lifted around or over any interfering projection much like caterpillar treads.

There are many advantages in the use of the lifter shown,—in that it does not tie up the drop table,—and where there is no suitable area under the drop table to exchange generators, the lifter can be utilized. The one shown was built in the machine shop at Mott Haven at a very modest cost. It is now being considered on a system-wide basis.

Above: A generator being lowered onto the jack in its fully lowered position—Left: The jack as used to raise a car generator up to its mounting position on car

Welded Gear Box For Diesel Traction Motors

Box fabricated from steel plates has all the necessary rigidity for holding shaft alignment—is cheaper and lighter than a casting

*By H. B. Cleary**

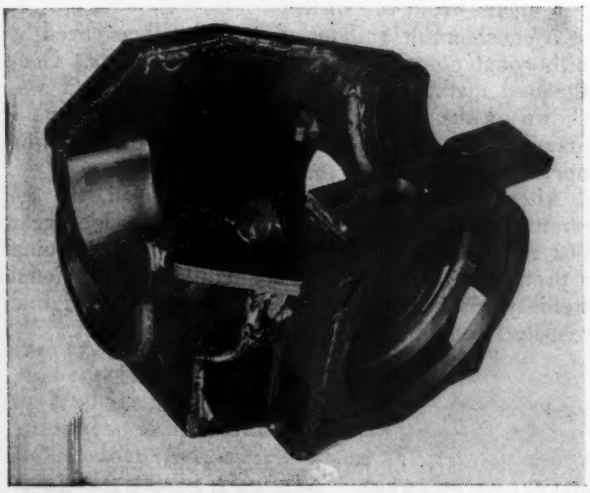


Fig. 1—A welded gear box before machining

THE production of a satisfactory cast-steel gear box for a double-reduction locomotive drive transmission is difficult because of imbedded sand, blow holes and variation in casting dimensions. In such a drive the high-speed reduction is hypoid gearing with the pinion mounted on the armature shaft of the d. c. traction motor. Anti-friction bearings support the motor armature shaft and the intermediate drive shaft in the transmission. The low-speed gear reduction is spur gearing with the final gear mounted on the locomotive axle. Sleeve bearings on the axle support the low-speed end of the transmission. All bearings in the transmission are oil-lubricated. The gear box forms the pinion end of the motor and the cooling air for the motor is exhausted out of the sides of the gear box through a chamber separated from the gearing.

Due to the difficulties encountered in manufacturing the cast-steel gear box, a study was made to determine whether or not it was practical to use a welded gear box instead. The design and cost studies showed that an improved product at lower cost could be made using this method. The only items involving appreciable expense were a welding fixture and burning templates. The machining tools

* Motor Division, General Electric Company, Erie, Pa.

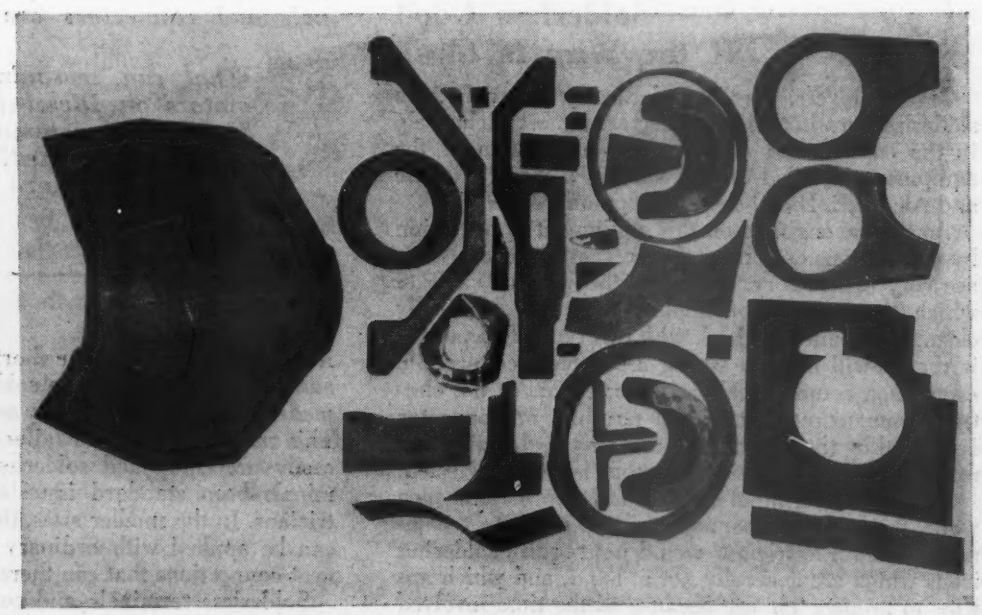


Fig. 2—Component parts of a welded gear box

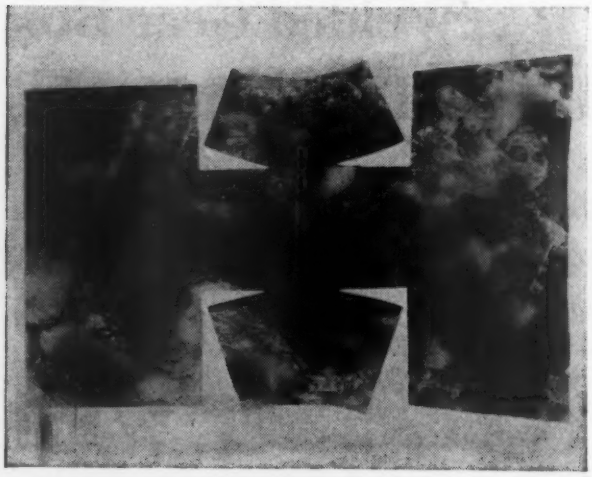


Fig. 3—Development of a welded gear box shell before forming

and fixtures made for the cast-steel gear box could also be used for the welded box.

The welded gear box before machining is shown in Fig. 1. It weighs 600 lb. as compared to 705 lb. for the steel casting. The component parts are shown in Fig. 2. These parts are burned from steel plates which vary in thickness from 6 in. for the U-shaped seats for the axle bearings to 3/8 in. for the main enclosing shell.

The 3/8-in. thick shell is formed cold in an inexpensive die by a hydraulic press. The development of this part before forming is shown in Fig. 3. This includes material which is shaped in partial cones during the forming operation. The partial cone-shaped sections of the enclosing shell fit over the rings which support the bearings for the intermediate gear shaft. This type of construction has proved very successful and saves fitting and welding time as compared with making the partial cones as separate pieces from the shell.

A considerable amount of steel plate was saved by a thorough study of nesting the various parts. Once the best method of nesting was determined, it was shown on the detail drawings instead of leaving the arrangement up to the judgment of the burning operator.

After welding operations are completed, the assembly is annealed at 925 deg. C. This welded gear box fully meets the original objective of developing a product with improved machinability, dimensional stability and quality at a lower cost than the original cast-steel gear box.

CONSULTING DEPARTMENT

Solderless Terminals

To what extent are solderless terminals and connectors suitable for railroad applications?

Solderless Good If the Wire Is Clean

My employers, the General Electric Company, use solderless terminals and connectors almost exclusively in the control and auxiliary power circuits of the equipment installed on the various General Electric and Alco-G.E. Diesel-electric locomotives.

As service engineer on this equipment in operation by our various customers, I find that in general they are very satisfactory. However, the wire or cable to which they are to be applied must be electrically clean. The main drawback with this type of connector is that it will make a strong mechanical connection, even when actually making a very poor, or no, electrical connection. A soldered terminal or connector is blessed by the fact that a poor electrical connection makes a poor mechanical one that is easily detected.

In railroad terminal service and trip maintenance work, the solderless connectors have much to recommend them. Electricians would not require soldering irons which are generally not at hand, and which are slow to prepare for use because of the time involved in heating them. With the short time intervals usually available to maintainers, a soldered connection is not made, and wires are usually merely twisted together. This results in a second failure that could have been easily prevented had solderless connectors and terminals been standard issue equipment to all electricians. In the smaller sizes, the solderless connectors can be applied with ordinary pliers making permanent connections that can thereafter be forgotten.

Solderless terminals and connectors are available

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

How can I be sure my solderless terminals and connectors are put on right?

What can seasoning do for traction motors on Diesel-electric locomotives? Should the commutators of rewound motors be seasoned? What is the recommended procedure for the process of seasoning?

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in small compact and inexpensive kits that contain terminals and proper tools for their application. With such equipment made available to them, railroad electricians could always make strong and permanent repairs that would cause no trouble, provided the wire is properly cleaned before the terminal is applied.

GUY FORBES
General Electric Company

Have Been Applied to Locomotives Since 1943

A.—The General Electric Company has been using solderless terminals for almost all of its switching and road locomotives' wiring in sizes where terminals have been available, since 1943. This includes both control and power circuits for all sizes up to 650/24 flexible stranded cable (262600 circular mils).

A pressure type motor lead connector is now available that is interchangeable either in whole or in part with the solder type connector we have used in the past, and we are preparing to change over to it for all sizes of motor leads. There has not been much occasion to use connectors for control wiring, but when there is, we use a pressure type and consider it satisfactory.

We have made numerous tests both as to electrical resistance and as to mechanical strength and have found that, in general, where the proper size of terminal is used, values for electrical resistance and mechanical strength obtained with the pressure terminal equal or are superior to those for the solder type.

R. L. CHAPMAN
General Electric Company

Used Almost Exclusively on New Cars and Locomotives

At the risk of sounding as though we are biased, we feel that solderless terminals and connectors are suitable for railroad applications without any limiting factors. This opinion is supported best by the fact that, in our estimation, at least 90 per cent of all wire and cable terminations going into the construction of new cars and new Diesel-electric locomotives are solderless connections. This covers the entire range of wire and cable sizes running from No. 16 or 18 wire to what is approximately one million c.m. cable.

It is also a fact that the great majority of signal wire terminations are solderless on any new installations which are currently under construction. Solderless terminals and connectors have been used in increasing volume by the railway industry and its associated and related industries for at least the past ten years.

F. A. LEACH
The Thomas & Betts Company, Inc.

Soldered Joints Stand Up

Soldered joints and solderless terminals and connectors each have their merits. It is our opinion that solderless terminals would have limited application in the railroad field because of the possibility that the joint might become severed due to the unusual amount of vibration which would be encountered in railroad equipment. We believe that soldered joints would stand up much better in this type of service.

Up to the present time, the soldered joints have been widely used in railroad work with good success. On the other hand, solderless terminals are new and probably have not been fully tested for railroad applications.

It is difficult to evaluate the service that can be obtained with solderless terminals without making tests of the specific application. The terrific pounding received by railroad equipment leads us to believe that they should not be recommended unless specific tests were performed. We say this even though we believe that solderless terminals have considerable merit for certain applications. The severe demand of railway service would necessarily require such procedure.

A. E. ST. JOHN
American Smelting and Refining Company

Ask the Man Who Uses Them

I wonder how many persons throughout the railroad systems have repeated this same question or asked a similar question. The reasons for questions like this are many, and the simplest answer may be found by asking any one of the many, many railroad men who are now using solderless terminals and connectors on their systems.

One answer could be offered by providing a great amount of technical phraseology which would be descriptive information obtained as a result of laboratory tests of solder terminals and connectors versus solderless terminals and connectors.

Another answer may be that solder terminals have been supplanted, in a vast majority of instances, by the use of solderless terminals which are applied mechanically, making better, more uniform mechancial and electrical connections. The use of solder requires soldering irons, flux, solder and the necessary auxiliary equipment. Solder does not provide a good electrical and mechanical connection because of the danger of "cold" joints, solder-hardening of the wire, danger of corrosion from soldering fluxes and poor vibration resistance.

I would prefer to answer this question in the following manner. Solderless terminals and connectors are the result of "Precision Engineering Applied to the End of a Wire," which was found necessary because wire terminations are major electrical problems and, therefore, must be solved by applying good, sound engineering practices. Such procedures have resulted in the present wide usages of thousands upon thousands of different solderless terminals and con-

nectors in almost every conceivable industry application and equipment. They afford complete uniformity of electrical connections because they represent the one method of wire termination that is scientifically controlled. Such factors as weight and size (which are held to unusually close tolerances) and positive connection to wire by precision crimping achieve electrical and mechanical characteristics impossible with other methods. In military, naval and aircraft services, they have had to withstand almost every conceivable adverse condition—heat, cold, salt spray, altitude, fungi, sunlight and destructive tropical humidity—from months to years at a time.

All this is particularly true of solderless terminals and connectors which have been pre-insulated with plastic insulation. By pre-insulation, I refer to solderless terminals and connectors which have the plastic insulation bonded to the copper of the terminal. This type of terminal construction is exceptionally well suited to railroad operation since the insulation is a part of the terminal and can never be forgotten.

Then, too, there is a corrosion-proof coating which may be applied to the afore-mentioned and described terminals and connectors resulting in the finest condition for wire termination. Both the initial and subsequent resistances of a corrosion-proofed terminal are less than those of the same type terminal without corrosion-proof coating. This should be most interesting to all signal and communications engineers where resistance is known to be a very troublesome factor of poor connections.

In a demonstration of the low resistance and uniformity of connections which may be obtained from solderless connections, 14,398 crimped connections were made by using 7,199 short lengths of wire to connect 7,200 small butt connectors together in order to establish a resistance of 1 ohm. This is an excellent example of the fine results which can be expected when using solderless terminals and connectors.

Crimps of many designs and types for use on solderless terminals and connectors have been developed for almost every conceivable application. Many of these crimps are specifically designed for a particular application to assure optimum performance. This is true of terminals for use in railroad operation. These crimps deform the wire sufficiently to expose fresh, unoxidized surfaces, thus assuring good electrical conductivity. They resist high corrosion and vibration.

The use of crimped solderless terminals and connectors has been approved by practically every important commercial and government agency. Such a wide acceptance of an idea must be worth further investigation.

In the mechanical application of solderless terminals and connectors uniform mechanical and electrical connections are obtained by the use of specially designed application tools which automatically guarantee the user a completed crimping operation at all times, thus assuring uniform termination results. Tools of this type are particularly suited to railroad work—they eliminate the possibility of human failure, a not uncommon failure in railroad work. Identical uniform connections are made with a single operation of installation tooling resulting in higher efficiency and lower installation costs. No highly skilled labor is needed and less inspection is required; no extra items must be stocked or handled; installations are simple and inexpensive.

Tremendous savings are now enjoyed by many railroads because of the use of solderless terminals and connectors on new construction work. Substantial savings are made in time and money as a result of their use on service and repair work.

Applications of solderless terminals used on Diesel-electric locomotives are those on the secondary wiring of control panels. On rolling stock they are used on panel boards which control lights, air conditioning, fans, and in fact anything that needs electrical application in the car. Also, solderless terminals and solderless connectors are designed for maintenance and repair to replace terminals and connectors used by original component part manufacturers.

Space here does not permit the disclosure of the wealth of engineering work concluded with respect to solderless terminals and connectors. It would be advantageous, therefore, to consult with the manufacturers. If the solderless terminal or connector which you require is not now manufactured, it can be produced for the asking.

L. B. PAULES
Aircraft-Marine Products, Inc.

Effect of Commutator Condition on Brushes

What effect does commutator condition have on brush performance?

Causes of Bad Commutation

In the design of electrical machines, the industry has progressively moved away from the large slow-speed motors toward those of smaller size and higher speed. This trend is particularly noticeable in traction motors where the resulting saving in space and weight is especially important. Along with the higher speeds, there is the trend toward more power and higher operating temperatures. These higher speeds and higher temperatures bring with them a somewhat different set of conditions for commutation.

Commutation, fundamentally, is the process of collecting current from a set of moving electrical contact surfaces while at the same time short-circuiting those coils in which the current is undergoing reversal. As there is a voltage, even though small, generated in each of these short-circuited coils, a circulating current is present in the face of the carbon brushes in addition to the load current. This circulating current under some conditions becomes high enough to cause sparking between carbon brushes and commutator bars. The voltage causing this circulating current to flow is proportional to the load current and to the speed; hence it becomes a more serious factor in modern high-power machines. The use of commutating poles, sometimes called interpoles, has the

effect of decreasing this sparking voltage but not entirely eliminating it. A commutating pole and its coil can be so designed and adjusted that they compensate for the *average* voltage of the coils undergoing reversal. Since several coils are imbedded in each armature slot, the coils may not all be compensated equally. The energy of the last one to undergo commutation may then result in a spark at the brush. This accounts for the appearance, frequently found on commutators in service, of darker and lighter colored commutator bars with a regular pattern. When three coils are used in each slot, every third bar may be dark; when four or five coils are used per slot, every fourth or fifth bar is dark, and so on.

Good commutation depends upon a very intimate contact between the commutator bar surfaces and the carbon brush. It has been found that a uniform light chocolate-colored film of oxide deposited on the surface of a commutator during service is an indication of the best condition of contact. In contact with this film is the face of the carbon brush, which is itself composed of a large number of contact points of small area. The best electrical contact depends upon having the combined area of these points as great as possible. Any factor which disturbs either the contact area of the brush or the smooth film on the commutator impairs good commutation.

Commutator eccentricity is a factor that tends to decrease the effective area of contact. Its effect is not serious when the eccentricity is not more than .002 or .003 in. but may become increasingly important at high-speed operation when it is about .005 in. or more. The word "eccentricity" in the foregoing is used to apply only to a smooth or uniform eccentricity, characterized as a long wave. It is greatly different from surface irregularities, or roughness, that are characterized as short, choppy waves. Such short and abrupt high or low spots are far more difficult for a carbon brush to ride smoothly than a long smooth wave.

One of the causes of commutator surface roughness is excessive sparking or flashing which leaves small beads of copper on the edges of the commutator bars. After this happens, brushes wear out rapidly, for it becomes increasingly difficult for the brushes to maintain good contact with the commutator. This condition is cumulative, particularly at heavy loads, and can lead to serious trouble.

Another cause of surface roughness is inherent in the construction of the commutator itself. A commutator, being a complicated assembly of many elastic parts, will give smooth operation only when those various parts are kept in proper relation to each other. A movement of just a few copper bars with respect to the other bars leads to roughness, sparking, and rapid brush wear. To prevent any such non-uniform movement, commutators must be kept tight enough that the relative motion of any part is held to a minimum. An old commutator that has developed looseness in service should be baked, pressed, and tightened in accordance with the recommendation of its manufacturer. A commutator that is tight enough, and mechanically sound, is affected by changing conditions, such as temperature or centrifugal force, but the effect is not of such a nature as to interfere with commutation. Instead, there is a redistribution of forces inside the commutator, while allowing the assembly of bars to expand uniformly.

Another unfavorable condition is called "high mica" and occurs when any of the mica between commutator bars extends higher than the adjacent copper bars, causing the brushes to jump and spark. High mica is caused either by the copper wearing down faster than the mica or by an incomplete undercutting job. After under-cutting the mica between bars, all of the bar edges should be scraped clean, not allowing any mica slivers to extend up along the sides of the bars and give trouble later.

Many kinds of foreign matter sometimes enter a traction motor and cause trouble when they reach the commutator. Among these materials can be listed sand, brake-shoe dust, salt water, and oil. The effect of any abrasive dust is to grind off part of the commutator surface film and wear down the brushes. Salt water resulting from the use of salt at track switches during winter months can lead to shorts between bars, thereby causing more sparking. Oil found too frequently on the electrical parts of motors or generators in Diesel locomotives, is particularly objectionable. The oil catches dirt and carbon particles and soon builds up a conducting path in the under-cut slots or along the surface of the mica V-ring. Current passing along these paths breaks down the oil to deposit more carbon, and the condition becomes progressively worse, sometimes even eating away a large hole in the copper and mica and causing a complete failure.

It has been found that when a machine is operated at light load, or no load, for a long time, there is a tendency for the surface coat of oxide to undergo a gradual change. When this continues long enough there remains a copper surface which has a much higher friction than the desired light chocolate brown oxide film. This makes the brushes chatter with a high-pitched noise and wear down rapidly or break.

While the foregoing discussion of commutation deals particularly with the condition of commutator surface, it is well to enumerate other important factors affecting commutation, all of which should be investigated when trying to correct trouble. They are:

1. Shorted turns on interpole field coils.
2. Shorted turns on main field coils.
3. Carbon brushes sticking in holders.
4. Incorrect grade of carbon brush.
5. Incorrect brushholder spring tension.
6. Brushholders out of parallel.
7. Brushholders not uniformly spaced.
8. New carbon brushes not sanded to fit.
9. Armature vibration due to unbalance.
10. Vibration caused by external sources.
11. Overloading.
12. Overspeeding.
13. Open-circuits in armature coils.

The collection of current from fast-moving contacts is thus seen to be a rather complex operation. It is performed most successfully, with a minimum of brush wear, when all factors that affect it are favorable, and one of the most significant of these factors is the condition of the commutator surface.

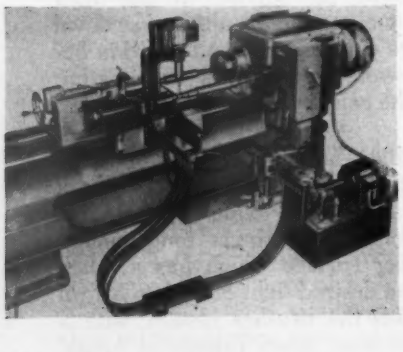
RICHARD E. KELLY
Westinghouse Electric Corporation

NEW DEVICES

Hydraulic Tracer Lathe Control

Recently announced by the Lodge & Shipley Co., Cincinnati, O., is a new tracer-controlled dual-purpose lathe. Known as the Copymatic, the machine embodies an all-hydraulic tracer control in the company's standard Model X 16-in., 20-in. medium and heavy duty, and 25-in. medium duty lathes.

A feature of the lathe is the ease and facility with which the unit can be converted from standard lathe operation to automatic duplication and vice versa.



Changeover is instantaneous, accomplished by turning two valves and a switch.

On duplicating work, the tracer will operate from round or flat templates, doing turning or boring jobs within the range of the lathe equipped with tracer control. Reproduction of multiple diameter shafts with square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours as well as similar boring operations are performed efficiently, quickly and to a high degree of accuracy.

In many cases, the need for a template is eliminated. The first piece of a lot can be machined by standard operation of the lathe; this piece is then used as a template for the production of the balance of the lot.

The swing capacity of the standard lathe is maintained because standard compound rest and cross feed screw assemblies are used and directly connected to the hydraulic piston operating within the cylinder mounted on the rear of the carriage. This feature and the fact that the machine may be used for either standard or duplicating work without limiting the range of either, removes the unit from the special purpose machine classification.

The hydraulic tracer equipment includes a hydraulic pump and motor, purolator, air filter, tracer head and one stylus, valves and switches, hydraulically-operated clutch and brake for controlling longitudinal feed, hydraulic piston and cylinder for cross feed control and supports for the templates.

Stainless Steel Welding Electrode

An electrode has been developed to weld Type 316-ELC stainless steel which is now produced in sheets, bars and plates. The unusual feature of this analysis, is that the carbon content is 0.03 per cent maximum.

With this small amount of carbon, it is possible to practically eliminate intergranular corrosion in the zone adjacent to the weld and in the weld deposit because carbide precipitation is prevented.

Properties of weld metal produced by the Welding Division, Champion Rivet Company, Cleveland 5, Ohio, are: Chrome 18 per cent, Nickel 13 per cent, Molybdenum 2.25 per cent. The physical properties as welded are: Tensile strength 85,000 to 95,000 lb. per square in. Elongation in 2 in. is 40 to 50 per cent.

Cord Trolley For Monorail Hoists

Manning, Maxwell & Moore, Inc., Shaw-Box Crane & Hoist Division, Muskegon, Mich., has announced a device called the "Budgit" conductor Cord Trolley. It is designed for supplying of electric current through a flexible conductor cord to electric hoists and other mobile equipment operating on monorail tracks. It differs from the usual arrangement in that the conductor cord is supported by the trolleys on the same track on which the hoist is installed.

It will permit the supporting of conductor cords around curves on monorail tracks and will go through the same switches as the hoist trolley.

The cord trolley provides a low cost method of supplying current to hoists and other mobile equipment on monorail tracks. It is practical to use this method of supplying current on tracks as long as 175 feet in which there are curves and switches. By using this method, the conductor cord is kept up out of the way. The drop of the conductor cord when looped may be kept as little as 2 feet.

Baking Varnish

A clear baking varnish, known as Synthite BE-301, composed of phenol formaldehyde resin and selected drying oils, has been formulated by the John C. Dolph Company, 1060 Broad street, Newark, N. J., for applications where high heat resistance and exceptional bonding is required. Because it cures by polymerization, this varnish will cure throughout to give a solid mass. It is particularly recommended as a transformer and coil varnish and can be used on all types of modern coated magnet wire. It is said to possess the advantage of maintaining a high degree of flexibility, even though the film is comparatively hard when cured.

The varnish can be applied by atmos-

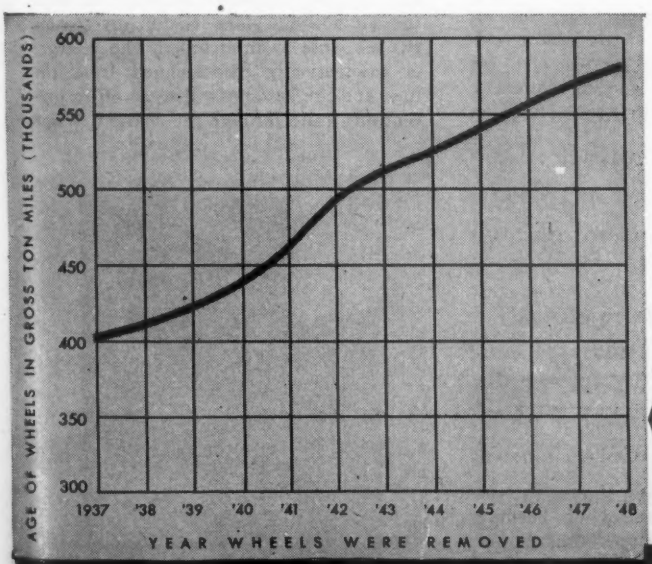
42% MORE SERVICE FROM Chilled Car Wheels

MORE WORK . . . in terms of greater ton mileage—that's the true yardstick of the extra measure of service you now get from Chilled Car Wheels. Figured that way, your wheel dollar rolls a lot farther today than it did ten years ago.

Let's look at the record. Back in 1938, Chilled Car Wheels removed from regular railroad cars showed an average of 410,000 gross ton miles of service. In 1948, however, wheels removed were delivering an average of 580,000 g.t.m.—an increase of 42% in service

America's railroads are working harder than ever these days . . . in stepped-up train speeds; in greater car loadings. And Chilled Car Wheels are measuring up to these extra demands with plenty to spare. For example: Average g.t.m. per wheel per year during 1930-1939 were 47,900 compared with 95,600 for 1942-1948—double the earlier average.

But that's not all. Looking ahead, you can safely expect even better performance from Chilled Car Wheels. Remember, wheels removed in 1948 were wheels cast in 1942, based on average age in years. We members of AMCCW have made some big improvements since then . . . in manufacturing methods . . . in testing and inspection. They all point the way to still greater service records from Chilled Car Wheels.



AVERAGE GROSS TON MILES OF SERVICE PERFORMED BY CHILLED CAR WHEELS REMOVED FROM REGULAR RAILROAD CARS IN EACH OF THE PAST 12 YEARS.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

AMCCW

448 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

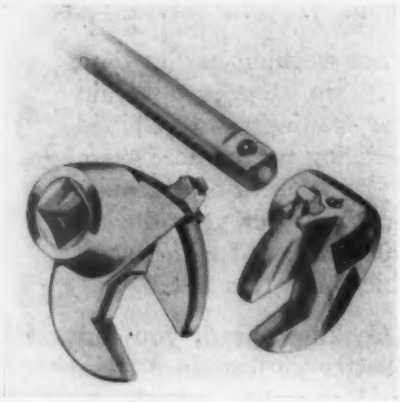
American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • New York Car Wheel Co. • Pullman-Standard Car Mfg. Co.
Southern Wheel (American Brake Shoe Co.)

pheric dip or vacuum impregnation and may be baked under infra-red lamps or in conventional gas or electrically heated ovens.

The build-up of this varnish is from 5-5½ mils per coat with a dry dielectric strength of over 1,500 volts per mil and a wet dielectric strength of over 1,000 volts per mil. It is moderately priced and does not require a special solvent. Naphtha may be used for thinning. This varnish may be obtained in all standard containers from 1 gallon cans to 55 gallon drums.

Adjustable Crowfoot Attachments

The J. H. Williams & Co., 400 Vulcan street, Buffalo 7, N. Y., has successfully combined, through the medium of one tool, the flexibility of the detachable socket system with the advantages of the open-end adjustable wrench in their adjustable crowfoot attachments. When used with the numerous handles and parts



available, the attachments present a large variety of combinations to handle nut turning jobs.

The Williams adjustable crowfoot attachments are made from alloy steel in two square-drive sizes, ⅜ in. and ½ in., with capacities of ¾ in. and 15/16 in. respectively. Square shoulders on the body portion of the sliding jaw provide the bearing against working stress.

Aluminum Alloy Portable Hoist

The Lincoln Precision Machining Co., North Grafton, Mass., has announced a portable hoist named Lug-All weighing only 8½ lb. and capable of lifting one and one-half tons.

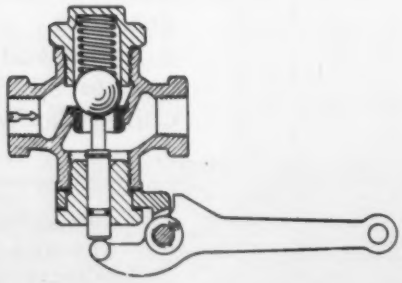
This hoist may be used by a single worker, saving the time of an extra man who normally helps to carry and lift older type hoists of the same capacity.

The handle may be reversed so that the user may take advantage of easier operating conditions in tight places.

Instead of a chain which often kinks, its construction employs a 133-strand aircraft cable which reels out easily without snagging. Limit for the cable is 15 ft., at which length the hoist capacity is 1,500 lb. When doubled (length 7½ ft.) the hoist's capacity is increased to one and one-half tons.

Air or Water Operating Valve

This valve is ideally adapted to these services as an operating unit; for air whistles, for control of pneumatic cylinders on lifts, hoists, presses, etc., for cleaning air blasts on forging hammers, as a small valve for general service in



machine, repair, railroad shops, etc., as a small valve for control of flushing liquids, and as a quick operating shower valve for emergency showers.

It is a self-sealing air or water operating ball valve known as Type BA-1, and has been announced by Leslie Co., 215 Delafield ave., Lyndhurst, N. J.

The valve is fitted with a quick-opening lever which may be adjusted to any horizontal position. The ball valve closes tight with inlet pressure and will not collect dirt or other foreign matter.

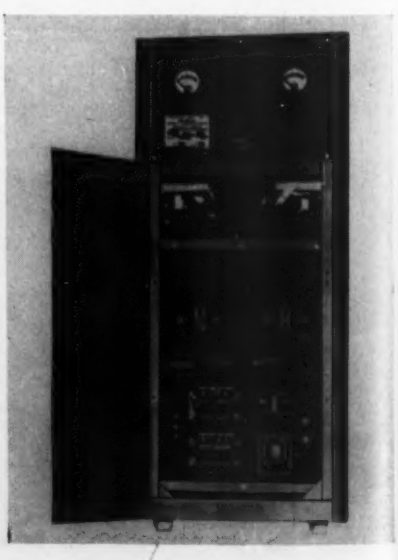
The stem is sealed by an O-ring not accessible to tampering or adjustment and eliminates a stuffing-box. It is self-packed by the operating pressure when the valve is open, permitting flow. Suitable for use with air, water, and other fluids of a non-corrosive nature up to 200 lb. per square inch pressure and temperatures up to 150 deg. F. air and 180 deg. F. water for many services where positive action and tight closing are necessary.

It is constructed with cast semi-steel body, integral rubber seat insert, screwed connections, ½-in. size and can be bushed to ¼-in. or ⅜-in.

Automatic Chargers For Truck Batteries

Full-wave selenium battery chargers for industrial trucks are now being made by the Richardson-Allen Corporation, 15 West 20th street, New York. There are two types of chargers, one for the constant-current charging of nickel-iron batteries and the other which includes controls for the two-rate charging of lead-acid batteries as well as the constant-current charging of nickel-iron batteries. The chargers are available in a number of sizes with charge-rates up to 180 amp., for 15 to 20 lead-acid cells or 20 to 30 nickel-iron cells. There are also smaller chargers for 6-cell lead-acid or 10-cell nickel-iron batteries.

All chargers conform to Electric Industrial Truck Association Specifications, and include automatic disconnect on both the a.c. and d.c. sides. If, for any reason, the a.c. line is interrupted, the charger is automatically disconnected from the line, and the battery is also cut off to prevent any drain through the charger. When



20 wheel sets in 8 hours

with profiling

The first car-wheel lathe with profiling attachment is now in operation at the Ivorydale shops of the B&O.

The Baltimore & Ohio reports that with this machine a pair of wheels can be turned in 12 to 14 minutes—and that normal production for an 8-hour day is 18 to 20 pairs!

* * *

This Niles profiling attachment is on a standard Niles hydraulic-feed car-wheel lathe. It permits the use of carbide tools—at speeds of 150 to 190 feet per minute with ½" feed per minute. With the carbide tools, shallower cuts can be taken to true up wheels. And a single cut completes the cutting, the finishing, and the flanging cycles, eliminating the use of separate finishing and forming tools.

In addition to the higher production, profiling brings these advantages:

- Both wheels are turned to exactly the same tape size.
- Minor skid flats can frequently be turned out with cuts of as little as ⅛ inch—at a big saving in metal (and wheel life!).
- Because of lower tool pressure, concentricities of .002 to .004 can be obtained—at least equal to those produced by grinding.

For further information, call the Lima-Hamilton sales offices in New York or Chicago, or write directly to Lima-Hamilton Corporation, Hamilton, Ohio.

LIMA HAMILTON CORPORATION

DIVISIONS: *Hamilton, Ohio*—Niles Tool Works Co.; Hooven Owens, Rentschler Co. *Lima, Ohio*—Lima Locomotive Works Division; Lima Shovel and Crane Division.

PRINCIPAL PRODUCTS: Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Locomotives; Cranes and shovels; Special heavy machinery; Heavy iron castings; Weldments.

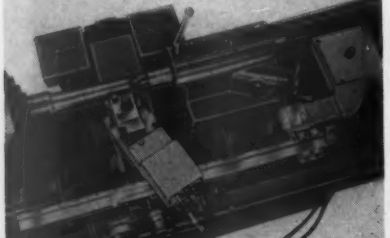
the a.c. voltage is restored, the chargers restart automatically. There is also short-circuit protection on the panel.

The only moving part is the ventilating fan, which is so connected that a fan failure will disconnect the charger from both a.c. and d.c. circuits.

A charging time control on the front panel regulates the duration of charge for from one to eight hours. The charging rate adjustment is made by means of a tap switch which is easily accessible to the maintenance electrician, but out of reach of anyone.

Hydraulic Tracer

A hydraulic attachment for shaft and profile contouring that can be installed without drilling or fitting on LeBlond heavy-duty lathes in the field has been announced by the R. K. LeBlond Machine Tool Co., Cincinnati 8, Ohio. Known as the "Hydra-Trace," the device accommodates stock to the full swing capacity of the lathe, and does not interfere with cross slide travel or prevent the use of the



taper attachment. The tracer is available in six different sizes for use on LeBlond heavy-duty-engine, the RT series engine and tool room, plain and sliding bed gap, and Rapid Production Lathes.

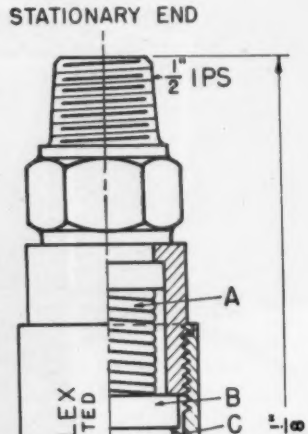
The Hydra-Trace is mounted on a special compound rest which is interchangeable with the regular compound rest in a matter of minutes. It is intended for both between-centers duplicating and for profile facing, and the shift from one to the other can be made easily and quickly. Since no drilling or fitting is required, the Hydra-Trace may be used on several different types of LeBlond lathes of identical size.

Operating on the template-actuated stylus principle, the Hydra-Trace brings automatic stepless contouring to the standard lathe. It will perform the complete range of operations, including straight facing and turning, tapers of any kind, shoulders, necking, concave and convex surfaces and spherical surfaces. A stylus control metering device is built directly into the compound rest. Diameters are adjustable by means of the lathe cross feed screw, and feeds are selected directly through the regular feed box.

The template holder and all controls are located in front of the lathe, and there are no overhanging brackets or controls in the rear. The Hydra-Trace is mounted so that it does not interfere with use of the taper attachment. The tee-slot on the tracer slide will take any standard or four-way tool block, and the slide may be swiveled to suit the most favorable angle for tool clearance.

Balanced Pressure Swivel Joints

A swivel point, trade marked Swivlex and manufactured by the Seamlex Company, Inc., 41-24 24th st., Long Island City, N. Y., is suitable for 400 pounds



per square in. maximum pressure and 600 deg. F. maximum temperature.

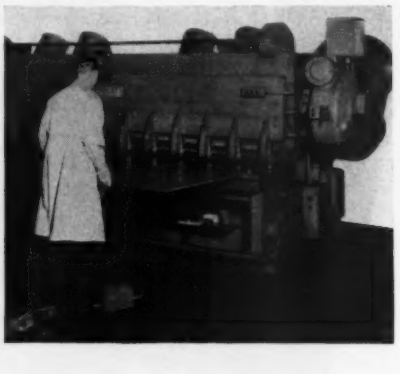
Features of the unit include: Easy swivel due to an internal equalizing chamber which balances the pressures on both sides of the seat; ball bearing which reduces the friction. No maintenance is required; neither replacement of packings nor adjustments nor lubrication. It is fool-proof because of an automatic internal stop which prevents accidental abuse in service and an invisible lock which prevents unauthorized tampering.

Standard sizes are up to 1-in. inside diameter; larger sizes are in preparation.

Remote Control Electric Clutch

A shearing attachment for their all steel shear has been made available by The Cincinnati Shaper Co., Cincinnati, Ohio.

The standard clutch tripping arrangement is a full length mechanical treadle. With it, the operator can work at any



position along the shear without the need for moving and positioning a separate foot control device.

If a large volume of wide or long plates and sheets are to be sheared, the electric clutch control will prove valuable. Applications of this remote control device to a shear increases its usefulness by speeding the handling, decreasing the man hours, and increasing the output of the machine.

The control is also furnished with two foot switches and a selector for single or double operator control. With double operator control, both operators must operate their foot switches before the clutch will trip.

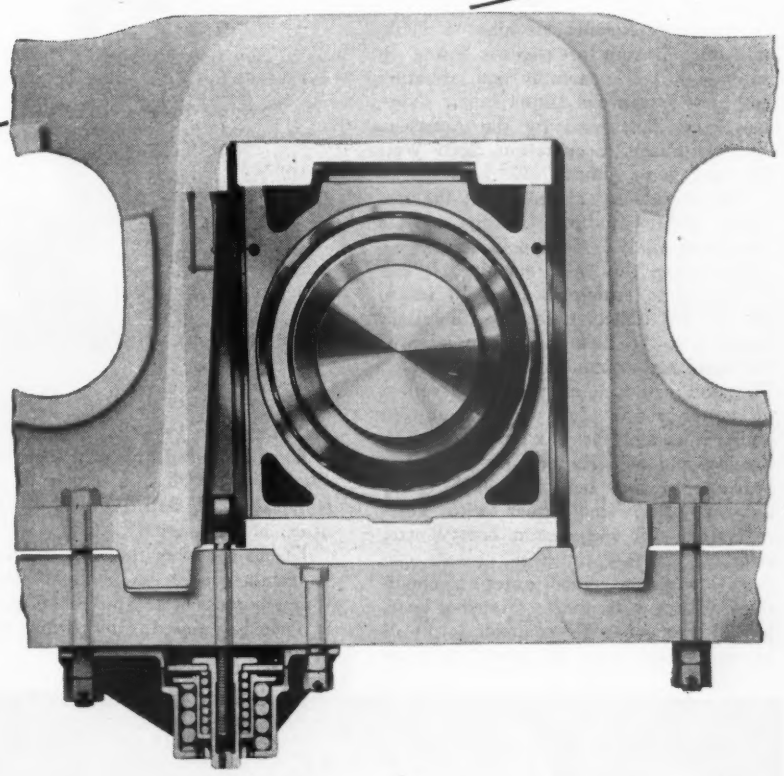
Improvements in Safety Headrest Goggles

The illustrated headrest goggles, No. W-50, have been improved for operator comfort in welding, cutting and brazing. They are light and comfortable to wear, simple to adjust, practical and easy to raise and lower and are available from General Scientific Equipment Co., 2700 W. Huntington street, Philadelphia 32, Pa.

Standard lenses of 50 mm. size are available in shades 3 through 6. They are

59 Roads Cut Maintenance Costs

. . . WITH COMPENSATORS AND SNUBBERS



Here are twenty of the fifty-nine railroads using Compensators and Snubbers. These roads have installed them on roller-bearing locomotives:

A. T. & S. F.
C. & N. W.
C. M. St. P. & P.
Clinchfield
Delaware & Hudson
D. M. & I. R.
D. L. & W.
Great Northern
Missouri Pacific
Northern Pacific
N. C. & St. L.
New York Central
Norfolk & Western
Southern Pacific
S. P. & S.
Texas & Pacific
Union Pacific
Western Maryland
Railways of France
National Railways of Mexico

Experience of 59 railroads clearly demonstrates that maintenance costs are reduced by the use of the Franklin Compensator and Snubber on driving boxes. Equally important with roller-bearing or surface-bearing locomotives, this device keeps the driving box, or housing, snug in the pedestal jaw, regardless of expansion or wear. Driving box pound is eliminated. Wear, and the possibility of failure, of crank pins and rod bearings are minimized. Tire mileage is extended by reduction of quarter slip.

FRANKLIN RAILWAY SUPPLY COMPANY

A CORPORATION

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
FIRE DOORS • DRIVING BOX LUBRICATORS • OVERFIRE JETS • JOURNAL BOXES • FLEXIBLE JOINTS • CAR CONNECTION

held in individual eye cups with cover glasses to protect the filter lenses from pitting.

Eye cups are of molded plastic, joined together flexibly, so they may be fitted against the face of the wearer. The outside of each eye cup has a ventilating screen and a baffle plate, which prevents fogging, yet keeps flying particles and stray light rays from reaching the wearer's eyes.

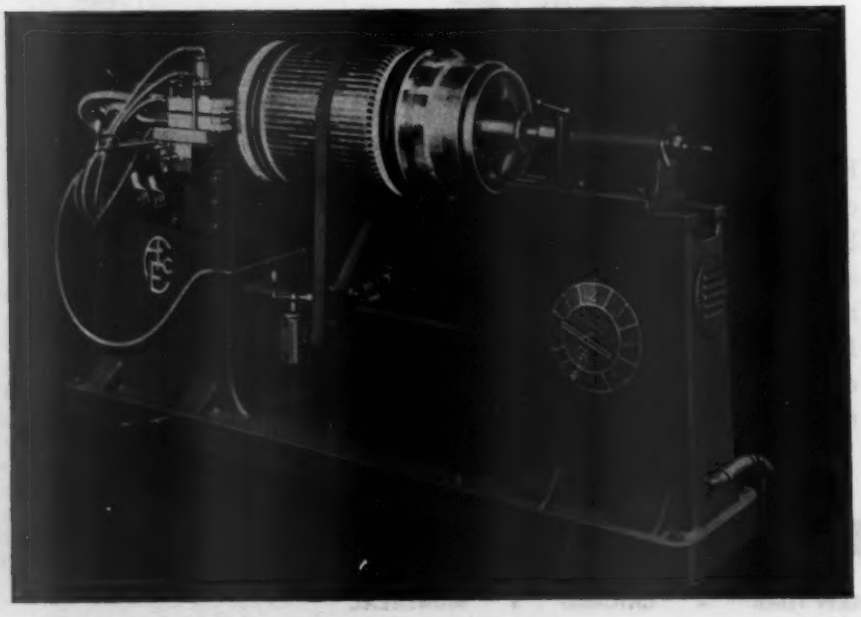
Goggle assembly is hinged from the sides of the headrest by telescopic arms. Concealed springs hold goggles gently against the face. The plastic headrest distributes the weight over the entire head.

Brazing Machine

A stationary brazing machine to facilitate the brazing or silver-soldering of railroad Diesel generator and armature coil ends in railroad Diesel repair shops, has been announced by the American Electric Fusion Corporation, 2606 West Diversey drive, Chicago 47.

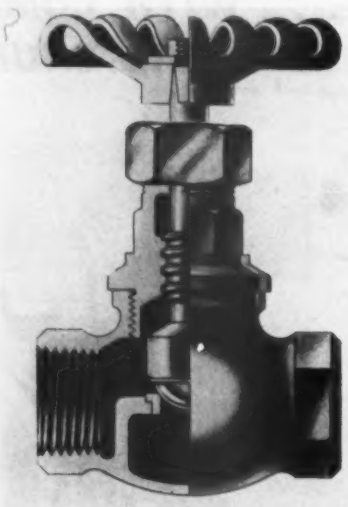
The manufacturer states that the machine insures uniform brazing results that meet all railroad specifications.

Known as the CBG machine, it can accommodate armatures from 18 in. to 42 in. in diameter, and with slight changes at the factory, can be adapted for handling armatures of greater size. The unit can also be used as a source of power supply for portable brazing equipment, and for a number of other brazing and soldering applications. The brazing machine has a built-in heavy duty 24 kva. transformer with auto-regulating coil and 8-point heat control selector that is claimed to provide efficient operation under exacting conditions, with a wide range of brazing heats for all size jobs. All common forms of brazing alloys may be used; such as foil, wire, strip and powder. Dimensions are 49 in. high x 24 in. wide x 99 in. long. It weighs 2,400 lb. Installation requires only connections to water and power supply lines.



Stainless Steel Ball Valve

The principles involved in the manufacture of this Bull-Dog valve mark a departure from former practices. In the



unit, available from The Carpenter Manufacturing Company, 4523 Detroit ave., Cleveland 2, Ohio, a precision ground stainless steel ball is used to replace discs, poppets, etc.

The ball used in the valve is spun into its retainer allowing a slight clearance, which permits it to spin when the valve is opened or closed. This permits the ball to find a new seat each time.

Care in manufacture has been exercised to hold the ball clearance accurately, thus preventing chatter when opening, closing, or throttling.

The ball valve is supplied with O-ring seals, for normal service where high temperature is not involved. Conventional steam packing is used in valves installed in steam or other high temperature service.

The illustrated valves are available in ½-in. and ¾-in. pipe sizes, in brass. Withstands water, oil, or gas pressure up to 300 lb.

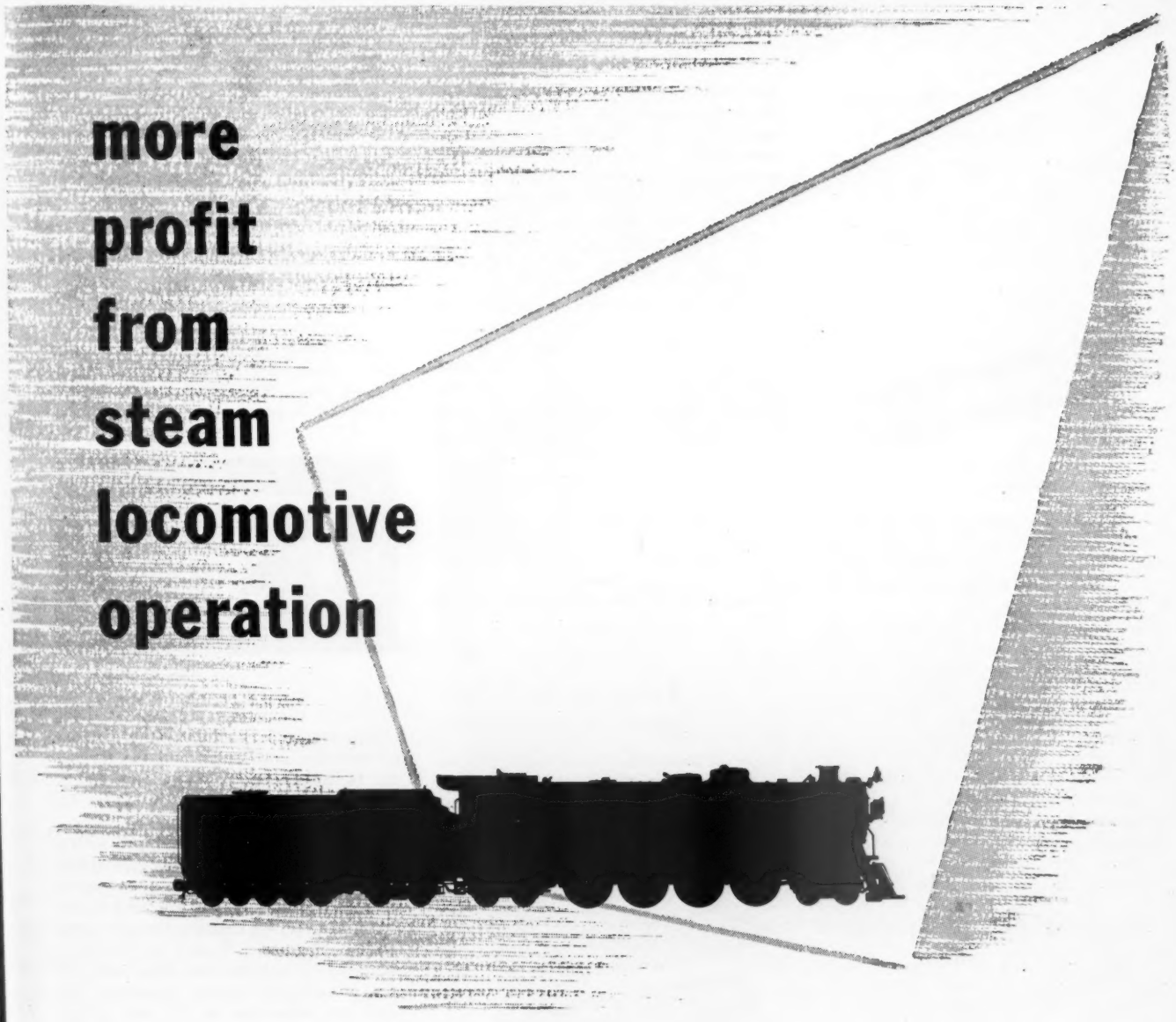
Aluminum Jack Supports

These journal jacks are used for inspecting and renewing railway journal brasses and other jobs where jacks of low height are required. They are available in six models: Nos. 2510, A2510, 3510, A3510, 5010 and 1510A. The latter model, however, has an open type ratchet lever socket where as in the others, the ratchet and elevating mechanisms are fully enclosed and dirt-proof.

The jacks, manufactured by Templeton, Kenly & Company, 1020 S. Central

ave., Chicago 44, are especially designed to replace wooden wedge supports and have a two-way upright for inverted use. Weighing only 8¾ lbs., the jack support is light weight and ease of placement makes it unusually adaptable on scaffolds.

Construction features include heavy duty chromemolybdenum steel thrust bearings that are hardened and ground. In addition, the jack has a heat-treated seamless alloy steel elevating sleeve, a heat-treated alloy steel lifting screw and heat-treated forged alloy steel gears.



Hundreds of steam locomotives now in road service are capable of giving many more years of really profitable operation if their efficiency is stepped up.

As shown by the experience of fifty railroads, steaming performance can be decidedly improved by installation of Security Circulators.

Security Circulators have the additional advantage of definitely lessening honeycombing, flue plugging and cinder cutting, thus making possible greater locomotive utilization and also affording a worth-while saving in boiler maintenance costs.

* * *

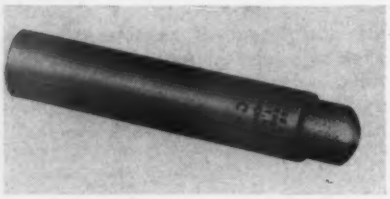
For nearly forty years American Arch has been designing and furnishing arch brick for coal-burning locomotives. Now American Arch has introduced the Security Dutch Oven to increase efficiency of combustion in oil-burning steam motive power, and installations have already been made in over two hundred locomotives.

American Arch Company Inc.

NEW YORK • CHICAGO

Diamond Dressing Tool

The illustrated tool, the IC-4, is designed for both rough and finish dressing or truing on surface, cylindrical, or centerless grinders. It will perform economically on all bond hardnesses of either alu-



minum oxide or silicon carbide grinding wheels. Its development has been announced by the manufacturer, Diamonds and Tools, Inc., 19345 John R, Detroit 3, Mich.

In addition to being universal in its uses, it is also comparatively fool proof from the human element standpoint.

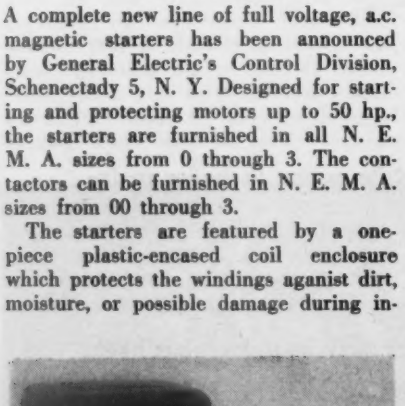
It employs the use of numerous small solid diamonds evenly distributed throughout a special Colmonoy wear resistant matrix. These small diamonds will always produce a sharp cutting edge due to their small cross section. The tool does not require resetting and can be used up completely without removal from the grinder.

A.C. Magnetic Starters

A complete new line of full voltage, a.c. magnetic starters has been announced by General Electric's Control Division, Schenectady 5, N. Y. Designed for starting and protecting motors up to 50 hp., the starters are furnished in all N. E. M. A. sizes from 0 through 3. The contactors can be furnished in N. E. M. A. sizes from 00 through 3.

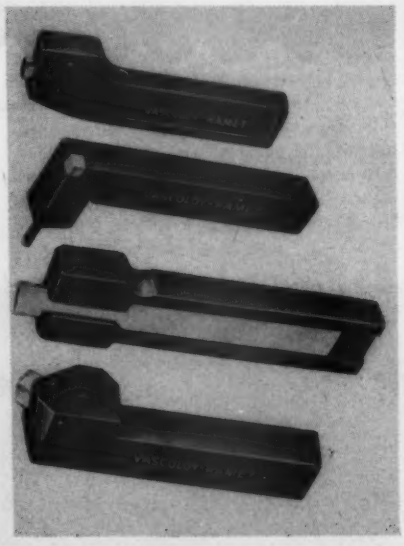
The starters are featured by a one-piece plastic-encased coil enclosure which protects the windings aganist dirt, moisture, or possible damage during installation. The clamp-type coil terminals are embedded in this enclosure to prevent loosening. Self-lubricated vertical slots in the sides of this enclosure permit the magnet armature guides to move quietly and smoothly. The silver contacts are easy to inspect, interchange, and remove without the use of special tools. Their large striking surfaces spread wear over a broad area, thus assuring long life, and the high initial tip pressure of the contact springs practically eliminates the possibility of tip welding. In addition, an arc shield of cold-molded asbestos prevents arc-over between contacts. The silicon steel magnet is exceptionally durable and has a permanent air gap in a non-wearing surface to insure quick dropout. All steel parts are zinc plated.

The starters are furnished either open or mounted in general purpose, watertight, dust-tight, or hazardous atmosphere enclosures. The general purpose enclosures have rounded corners and a corrosion-resistant finish.



Carbide and Cast Alloy Toolholders

A line of toolholders has been developed specifically for carbide and cast alloy inserts by the Vascoloy-Ramet Corporation,

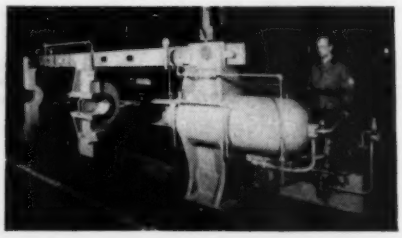


800 Market street, Waukegan, Ill., manufacturers of carbide and Tantung cast alloy tools. Known as the V-R Bulldog toolholder line, the products include vertical ejector-type toolholders to hold square, round, triangular, rectangular and parallelogram inserts of solid carbide or Tantung cast alloy in a complete range of sizes, as well as horizontal toolholders and inserts for turning, facing, boring and cut-off operations.

A feature of these toolholders is the method of holding inserts in position with a specially developed adjustable clamping pin. Of one-piece solid heat-treated steel construction, the toolholders eliminate the difficulties encountered in using carbide or cast alloy inserts in split-type toolholders.

Hydraulic Wheel-Mounting Press

To facilitate assembling or removing wheels, pulleys and gears, The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, has developed a line of self-contained hydraulic wheel presses with



capacities from 50 to 600 tons. A typical size has a 48-in. clearance between bars, 128-in. maximum daylight, (the distance between the ram facing and the face of the resistance yoke), 24-in. ram travel, and daylight adjustments in 24-in. increments.

The resistance yoke is equipped with a stop block which is used for contacting the end of the axle when mounting wheels. A throat block is provided on the end of the ram for clearing the axle when forcing on wheels. Remote push button operating control, mounted on a swinging arm, enables the operator to control the press ram movement at the most advantageous position.

A feature of this press is its power unit which consists of a variable-delivery oil hydraulic pump with direct electric motor drive. When high pressures are required, a booster unit doubles the normal pressure generated by the variable delivery pump. The combination of variable delivery pump and booster unit is said to assure smoother and more uniform pressure than that developed by a reciprocating-plunger type of pump.

Air Operated Impact Wrench

Heavy industry, especially locomotive shops, power houses and tie treatment plants, will find a valuable addition to their maintenance equipment in the large-capacity air impact wrench developed by the Ingersoll-Rand Company, Phillipsburg, N. J.

This impact wrench known as Size 577, is designed to handle large studs, bolts, nuts, and cap screws from 1¼ in. up to 2-in. thread size. It operates on the rotary impact principle, and the motor torque

A BIG OK ON THE KATY

IN April 1947, the Missouri-Kansas-Texas Railroad placed General Motors passenger locomotive No. 101 in service. Through June 1948, this 4,000 H.P. Diesel met assignments 100%.

The record of General Motors Diesels in freight service on the Katy is equally brilliant. As shown by the performance table below, seven General Motors Diesel freight locomotives in their first year of operation rolled up a total of 1,130,156 miles out of 1,144,376 miles assigned. Operating on fast daily schedules between Oklahoma, Texas and the North, they handled crack Katy freights an average of 13,697 miles per month, with a record of 98.76% availability based on assignment.

PERFORMANCE OF GM DIESEL FREIGHT LOCOMOTIVES ON M-K-T

Loco. No.	Month Delivered	Total Miles Assigned	Total Miles Operated	Avg. Miles Operated Per Month	Per Cent of Assignment Filled
201	6-47	164,012	161,538	12,996	98.49
202	6-47	172,715	170,453	13,746	98.69
203	7-47	160,689	158,716	13,742	98.77
204	7-47	163,776	162,335	13,934	99.12
205	7-47	161,408	159,468	13,771	98.80
206	7-47	162,578	161,130	14,036	99.11
207	7-47	159,198	156,516	13,705	98.32
	TOTAL	1,144,376	1,130,156	13,697	98.76

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

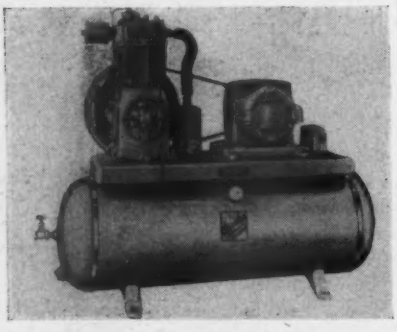
GENERAL MOTORS • LA GRANGE, ILL. • *HOME OF THE DIESEL LOCOMOTIVE*

is converted into 1,000 blows per minute. This principle makes the tool suitable for running or removing large nuts and for removing rusted or frozen nuts, and for drawing nuts and cap screws tight.

The wrench weighs only 72 lbs. (less socket) due to the use of magnesium in the housings. Other specifications are as follows: Overall length to shoulder of square driver—24¼ in.; side to center distance of hammer case—2 13/16 in.; rated capacity—2-in. bolt size; size of square driver across flats—1½ in. free speed—535 to 565 rpm.

Two-Stage Air Compressor

Six distinct model BF-type compressors, designed to supply compressed air for spray painting as well as air at higher pressures than normally used for spray finishing have been introduced by the



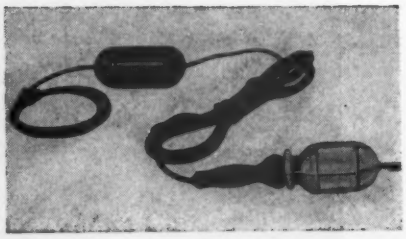
Binks Manufacturing Co., 3114 Carroll ave., Chicago 12.

They are built for 200-lb. working pressure and the tanks are tested for 300 lbs. The standard pressure setting is 160 to 200 lbs. and special settings are available. Displacement of the models range from 7.13 to 40 cu. ft. per min. Power is supplied by motors ranging from 1½ to 10-hp. capacity.

These units feature Timken main bearings, Lynite connecting rods, automotive-type pistons, non-breakable steel valves, copper-finned intercoolers, totally enclosed, dustproof crankcase and a new combination intake air filter and silencer. A constant-level lubrication system is used with all models, except the 10-hp. unit, which is pressure lubricated. Standard 1,750 r.p.m. motors used on these units (2-hp. and up) are equipped with overload protection starter switches.

Transformer for Portable Lamps

A portable safety transformer to protect users of portable lamps from electric shock is being offered by the Etraco Manufacturing Company, Inc., Woods Church road, Flemington, N. J.



Called Saf-T-Lite, the new device is a portable step-down transformer which has a 120-volt primary and a 6-volt secondary. It weighs 4½ lb.

The transformer is protected by a strong and water-proof Bakelite casing tested to withstand physical and chemical abuse. When connected to an outlet, the unit can be left on floor or table or it can be hung from any wall by a convenient hook which protrudes from the top of the transformer.

Also, in production, is a larger model designed to reduce a 220-volt lighting circuit down to 32 volts. Contained in an impact-resistant steel casing, this larger portable unit is intended for use in working areas where increased wattage for general lighting is desired, but under conditions which do not expose the user to the type of hazard for which the 6-volt unit is designed.

Both the 6-volt and 32-volt models are being made available either complete with trouble-lamp and 25 feet of heavy insulated extension cord, or just as safety transformers with insulated leads.

Windshield Wiper Arm

A windshield wiper arm, trade named the Clear-View, has been designed specifically for the railroad industry by Sprague Devices, Inc., Michigan City, Ind. The arm is made of rust-proof stainless steel polished to a high luster and uses any conventional type of heavy duty blade. It will withstand up to 150 in.-lb. of torque.

The arm will fit any straight-end shaft. The tension is adjusted by a self-locking nut located just above the mounting head. No special tools are required to remove the arm from the shaft; it comes free when the locking nuts are released. The stainless-steel mounting head block is a screw-tightened clamp which grips the 5/16-in. shaft with a vise-like action.

The wiper arm is available in two styles. In the conventional style the blade is fastened directly to the arm and gives a fan-shaped wiping pattern. The pantograph style is used principally for curved windshields where a greater percentage of window clearing is required. This style consists of the principal wiper arm plus a pantograph rod and a stationary flange which keeps the blade in a vertical position throughout its sweep and gives a pattern shaped somewhat like an arc.

Hydraulic Machinist's Vise

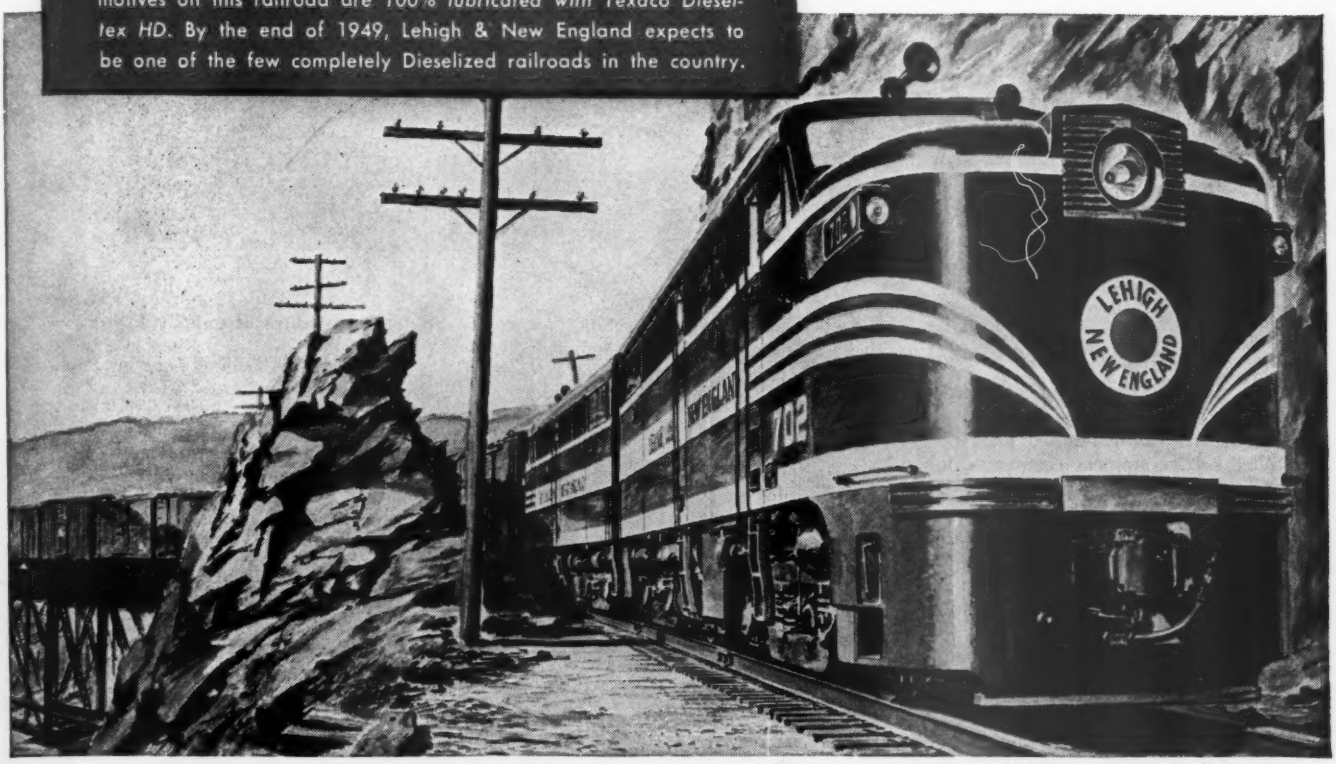
A swivel-type, foot-operated, hydraulic machinist's vise with 3½-in. jaw width and 6-in. jaw opening has been announced by the Columbian Vise and Manufacturing Company, Cleveland, Ohio. Being a foot-operated vise, it leaves both hands free for the operator to handle and position work between the jaws of the vise.

The vise has an adjustable production stop which can be set at any point within the full range of the jaw opening to hold a series of pieces of the same size and shape. The production stop is adjusted with the first work piece held between the jaws of the vise and then backed off to give just enough clearance for working. With such a stop, the operator can grip and hold normal work with one power pedal stroke and can obtain maximum pressure with not more than two strokes.

The vise has two foot-control pedals—one power, the other release. The power pedal provides a slow short movement of the front jaw and only eight strokes are needed for closing from full open position. Opening and closing of vise can be controlled at any point by the operator. While the hydraulic pump is made with a single power pedal, the pedal operates two pistons affording a greater displacement of the fluid which increases the closing speed of the vise jaw. The vise is opened automatically by pressure of an oversized coil spring, and the jaw is stopped at any desired position by removing pressure from the release pedal. When the jaws have been closed, maximum pressure for gripping and holding can be developed with two additional

strokes of the power pedal which provides a pressure of 6,000 lb. per sq. in. The vise is protected by a safety relief valve to prevent overloading of the hydraulic system and the vise itself.

LEHIGH & NEW ENGLAND'S railroad Diesel No. 702. All Diesel locomotives on this railroad are *100% lubricated with Texaco Dieseltex HD*. By the end of 1949, Lehigh & New England expects to be one of the few completely Dieselized railroads in the country.



Assure Cleaner Operation

. . . and get more mileage between overhauls by lubricating with Texaco Dieseltex HD

GET all the power and economy your Diesels are built to give you. Lubricate with *Texaco Dieseltex HD* — made to keep engines free of carbon, sludge and gum formations, assuring more trouble-free operation, greater protection, lower maintenance costs.

Texaco Dieseltex HD lubricating oils for railroad Diesels are fully detergent and dispersive. An exclusive formula, incorporating a special heavy-duty additive, assures high resistance to oxidation. These oils have been proved by rigid laboratory tests and actual road service . . . and more than meet the most stringent requirements of leading Diesel locomotive builders.

Texaco's unique Systematic Engineering Service embodies tests and controls that permit quick, positive evaluation of both engine and lubricating oils. A Texaco Lubrication Engineer will gladly tell you about it. Call the nearest Railway Sales Division office listed below, or write The Texas Company, *Railway Sales Division,* 135 East 42nd Street, New York 17, N. Y.

NEW YORK • CHICAGO • SAN FRANCISCO • ST. PAUL • ST. LOUIS • ATLANTA

TEXACO

TEXACO Dieseltex HD

FOR ALL RAILROAD DIESELS

Tune in . . . TEXACO STAR THEATRE every Wednesday night starring Milton Berle. See newspaper for time and station.

NEWS

Freight-Car Installations Exceed 10,000

During April, for the second consecutive month, freight cars installed by the Class I railroads and railroad-owned privately-controlled refrigerator car companies, totalled more than 10,000, according to the Association of American Railroads. The April installations were 10,027. The 10,556 installations for March were, according to the A. A. R., the highest "than in any other month in more than 20 years."

Mechanical Division Circular Letters

Car Repair Labor Rates

On account of increased labor rates for railroad employees engaged in car repairs, the A.A.R. Mechanical Division has just issued a revision of Interchange Rules 107 and PC-21. Modifications of other combination allowances which include labor will be effective in a special supplement to the 1949 Code, soon to be issued.

Terminal Checking of Wrought Steel Wheels

Serious complaints of thermal checking of wrought steel wheels in passenger service have been under consideration by the Committee on Wheels and the Joint Subcommittee on Standardization of Wrought Steel Wheels. Upon recommendation by these committees, the General Committee has authorized the following emergency action:

Effective immediately, the maximum carbon content for Class A multiple-wear wrought steel wheels as specified in Section 8 of Specifications M-107-47, is reduced from 0.63 to 0.57 per cent.

Further study and investigation will continue, following completion of which recommendations for further revisions of the Specifications, if necessary, will be submitted.

Marking Diesel Wheels

The Committee on Wheels in its 1947 and 1948 annual reports directed attention to cases of failure of Diesel locomotive wheels through cracks originating in the identification stamping on back face of rim. The number of such failures subsequently reported has been increasing and the matter was referred to the Joint Subcommittee on Standardization of Wrought Steel Wheels, the Committee on Wheels and the Committee on Locomotive Construction. Upon recommendation by these committees the General Committee has authorized that:

Effective immediately, the marking requirements as specified in Section 15 of A.A.R. Specifications M-107-47, are abrogated insofar as Diesel locomotive wheel designs H-33, F-36, A-40, C-42, BX-38 and AX-40 are concerned. In lieu thereof, the marking of wheels of the above designs shall be shown on print accompanying Circular Letter C-441.

Further study and investigations will continue, following which recommendations for further revision of the Specifications, if necessary, will be submitted.

Mechanical Division Program

The sessions of the twenty-third annual meeting of the Mechanical Division, Association of American Railroads, will be held in the Gold Room of the Congress Hotel, Chicago, June 27-29, inclusive. The program will be as follows:

Monday, June 27

*10:00 a.m. to 5:00 p.m.**

Address by G. Metzman, president, New York Central System.
Address by J. H. Aydelott, vice-president, Operations and Maintenance Department, Association of American Railroads.
Address by The Hon. W. J. Patterson, Member, Interstate Commerce Commission.
Address by Chairman, Mechanical Division, A. K. Galloway, General Superintendent Motive Power and Equipment, Baltimore & Ohio.
Action on minutes of annual meeting of 1948.
Appointment of Committees on Subjects, Resolutions, etc.
Unfinished business.
New business.
Report of General Committee.
Report of Nominating Committee.
Discussion of reports on:
- Locomotive Construction:
  - Steam and Electric Locomotives Section.
  - Diesel Locomotive Section.
  - Gas Turbine Locomotive Section.

Tuesday, June 28

*9:30 a.m. to 5:00 p.m.**

Address by J. E. Goodwin, vice-president and executive assistant to president, Chicago & North Western.
Discussion of reports on:
- Arbitration.
- Prices for Labor and Materials.
- Brakes and Brake Equipment.
- Geared Hand Brakes.
- Loading Rules.
- Specifications for Materials.
- Couplers and Draft Gears.
- Lubrication of Cars and Locomotives.
- Development of Hot Box Alarm Devices.
- Safety Appliances.

Wednesday, June 29

9:30 a.m. until program is completed*

Meeting called to order.
Discussion of reports on:
- Tank Cars.
- Wheels.
- Car Construction.

Election of members of General Committee and Committee on Nominations.
Report of Committee on Resolutions.

* Chicago Daylight Saving Time.

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE MAY ISSUE

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Central of Georgia	5	1,500-hp. Diesel-elec. road switch	Fairbanks-Morse
	2	1,000-hp. Diesel-elec. road switch	Baldwin Loco.
Chicago & Eastern Illinois	10	1,500-hp. Diesel-elec. road units	Electro-Motive
	4	1,000-hp. Diesel-elec. switching units	Electro-Motive
Atlantic & Danville	6	1,500-hp. Diesel-elec. road switchers	American Loco.

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Wabash	200	50-ton hopper	Co. shops

FREIGHT-CAR INQUIRIES

New Jersey, Indiana & Illinois	50	50-ton auto box
Southern	200	70-ton covered hoppers

The Atlantic & Danville, which begins independent operations on July 2, at the expiration of a lease held by the Southern since 1899, will be completely Dieselized after receipt during the third quarter of this year of these locomotives which will cost approximately $900,000.

NOTES:

Pacific Great Northern.—The Pacific Great Eastern is contemplating the purchase this year of the following freight-train cars at the indicated probable costs: 50 flat cars ($225,000), 10 gondola cars ($30,000) and 4 cabooses ($20,000).

Railroad passengers and railroad maintenance men alike can appreciate the effectiveness of ***Wyandotte Raltec.*** This specialized compound not only leaves coaches clean and inviting—it also does its work safely and economically.

Raltec is designed especially for the maintenance cleaning of railroad coaches, baggage cars and other equipment with painted, enameled, and lacquered surfaces. Repeated laboratory and field tests have shown it to be safe on these surfaces, as well as on workers' hands, brushes and clothing. Its superior wetting and cleansing properties speed the removal of traffic soils and bring out the full luster of the finish.

Wyandotte Raltec is used alone to the satisfaction of many customers. However, to assure maximum surface life, it is recommended that the Raltec solution spray be followed by brush application of a Wyandotte C-12 solution. This prevents corrosion, increases brush life and provides a superior cleaning job.

Your Wyandotte Representative will be glad to demonstrate the advantages of these and other Wyandotte Products at your convenience.

Wyandotte
REG. U. S. PAT. OFF.
WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan • Service Representatives in 88 Cities

QUICK

Pipe Reaming

THAT SAVES PIPE

RIDGID
Extra-Long-Taper
Reamer won't thin,
flare or split pipe

● Secret of the RIDGID's safe easy reaming is its extra long taper. With a few light ratchet turns, you whisk the burr from pipe or conduit without fear of thinning, flaring or splitting. You save time, work *and* pipe. Two sizes: No. 2, ⅛" to 2"; No. 3, ⅜" to 3." No. 2 reamer unit available without ratchet handle for use in RIDGID No. 00R threader handle. Ask your Supply House.

Reamer unit fits RIDGID No. 00R Ratchet Handle.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO

SUPPLY TRADE NOTES

SUPERHEATER COMPANY, DIVISION OF COMBUSTION ENGINEERING-SUPERHEATER, INC.—*T. F. Birmingham*, vice-president of the Superheater Company, division of Combustion Engineering - Superheater, Inc., at East Chicago, Ind., has retired.

Mr. Birmingham began his career as a machinist apprentice in the Union Pacific shops at Omaha, Neb., and subsequently became inspector of new U. P. locomotives at the builders' plants. On November 1, 1911, he joined Superheater, then the Locomotive Superheater Company, and worked as inspector for the company at the locomotive builders' plants. During 1930 he was appointed works manager of the company's East Chicago plant and, in May, 1946, was elected vice-president.

◆

AMERICAN STEEL FOUNDRIES.—*Goff Smith* has been appointed sales engineer for the American Steel Foundries, at New York. Mr. Smith joined the company in 1946, after six years in the Army Ordnance Corps.

◆

TIMKEN ROLLER BEARING COMPANY.—*Homer L. Hexamer* has been appointed district manager of the railway division of the Timken Roller Bearing Company at St. Louis, Mo.

Mr. Hexamer is a graduate of Purdue University. He joined Timken in 1928

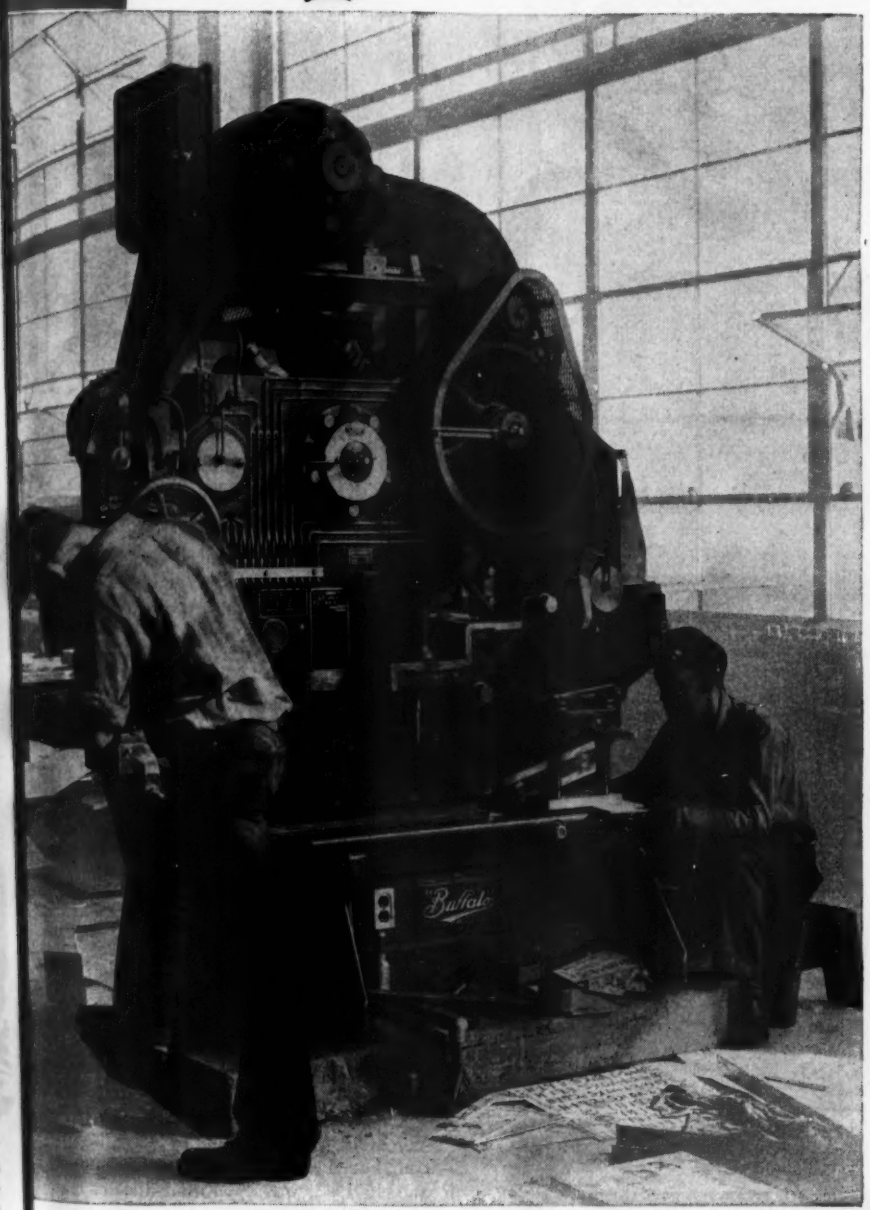
(Continued on page 352)

Diesel-Locomotive Builders Cut Prices

Six domestic manufacturers of Diesel-electric locomotives have announced price reductions of approximately 5 per cent. The American Locomotive Company's reductions, which became effective at midnight, April 17, ranged from $4,000 to more than $9,000 per unit. Reductions by the Electro-Motive Division of General Motors Corporation (see page 292 May issue), the Baldwin Locomotive Works and Fairbanks, Morse & Co. were effective on deliveries made on and after April 18. Baldwin reductions range from $4,400 on a 750-hp. switching unit and $5,000 on a 1,000-hp. switching unit to $10,600 on a 2,000-hp. heavy-duty transfer unit. In the case of a four-unit, 6,000-hp. freight locomotive, the reduction amounts to $31,400. The Lima-Hamilton Corporation, which makes only 1,000-hp. switching units, reduced the unit price by $5,000. The General Electric Company announced the price reduction of 5 per cent on its 44- and 70-ton standard Diesels became effective on all shipments on or after April 18.

"Handiest MAINTENANCE Tool in the Shop"

"Buffalo" UNIVERSAL IRON WORKER



"EATING UP THE WORK"
Man at left is punching holes in angle piece while man at right is shearing flats. Note bar cutting head in center, which can also be in operation.

CUTS—PUNCHES SHEARS!

Saves HOURS *In a Day!*

● Think what this universal tool can do for your shop—handling up to three fabrication jobs at once — smoothing out many "bottlenecks" in maintenance — cutting man-hours! Small wonder U.I.W. users call this rugged, 24-hour-a-day machine the "most useful one in the shop".

You can pick the style to suit your operation from five "Buffalo" models — including a built-in notcher, and coping attachment, if desired. Tools are quick to change, operation is easy. It's a rigid, powerful machine — accurate and durable on the job. Many served 'round the clock during the war and are still getting the work out at a punishing pace. Put a U.I.W. on your many jobs—watch output zoom and costs drop!

Write for Bulletin 360-A Here's practical information on the quick, low-cost way to handle the HEAVY work in your shop. Write now!

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

174 MORTIMER STREET BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

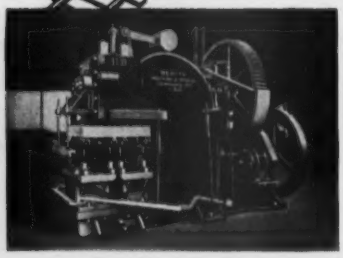
DRILLING PUNCHING SHEARING CUTTING BENDING

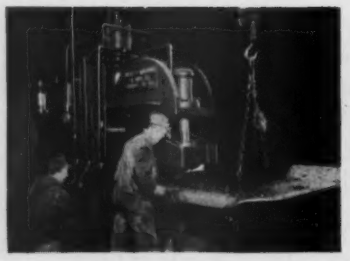
BEATTY

RAILROAD SHOP EQUIPMENT

WITH SPECIAL FORMING DIES AND PUNCHING TOOLS

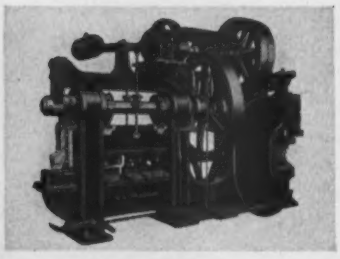
No. 11-B HEAVY DUTY PUNCH offers exceptionally large die space, can be tooled to handle most complicated job in a single pass. Tooling of punch and spacing table always designed to the specific needs of the job to be done.





PRESS BRAKE AND FLANGER, combination 40-ton Flanger and 300-ton Press Brake handles any type of plate bending required in car and locomotive repairs — flanging, V-bending, forming, pressing and straightening.

CO-PUN-SHEAR provides a combination of Punching, Coping and Shearing tools assembled in working position, driven by a single motor and operated by independent clutches. Designed especially for car repair shops.



HYDRAULIC BULLDOZER designed to perform a wide range of forming, flanging and bending duties in railroad car shops.

Write for complete information on the BEATTY line of mechanical and hydraulic punches, presses, shears and spacing tables.

BEATTY

MACHINE & MFG. COMPANY

HAMMOND, INDIANA

as a draftsman for the railway division and from 1933 to 1936 was a railway service engineer. From 1936 to 1946 he worked in the railway sales department at Canton, Ohio, and in the latter year

Homer L. Hexamer

was appointed sales engineer for the railway division at St. Louis.

M. S. Downes, whose appointment as general sales manager of the railway division of the Timken Roller Bearing Company was announced in the April issue, was born on September 11, 1901, in Buckhannon, W. Va. He attended the public schools there and in 1924 was a graduate of the Carnegie Institute of Technology with a degree in mechanical engineering. Immediately after, he was awarded a scholarship which, by 1925, enabled him to earn his master of science degree in mechanical engineering. He joined Timken as an engineer in 1926 and two years later was transferred to the then newly formed railway division. In 1928 he was appointed assistant to the general manager.

J. E. McCort, whose appointment as assistant general sales manager of the division also was announced in the April issue, was born on May 19, 1913, in Cleveland, Ohio. He received his higher education at Purdue University. He joined Timken as a service engineer in the Canton, Ohio, office in 1937, after a year on special assignment with the Wheeling & Lake Erie. In 1939 he was transferred to Cleveland as sales engineer and, in 1943, was appointed district manager of the railway division.

◆

BALDWIN LOCOMOTIVE WORKS.—*Marvin W. Smith,* executive vice-president of the Baldwin Locomotive Works since August 1, 1948, has been elected president and chief executive officer.

Mr. Smith is a graduate of Texas Agricultural & Mechanical College (1915) with a bachelor of science degree in electrical engineering. After graduation he joined the Westinghouse Electric Corporation. As a student engineer with that company he was selected by the late Benjamin G. Lamme, chief engineer of Westinghouse, for a special course of study in design problems. From 1917 to 1930, Mr. Smith was instrumental in the development of many important

Everything for finer performance . . .

You can have

DYNAMIC BRAKING

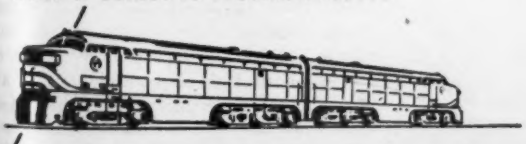
on any "C" Line Locomotive . . .

Another point of superiority of FAIRBANKS-MORSE Consolidation Locomotives

Now *your* choice and *your* requirements govern the election to buy—or not to buy—dynamic braking equipment. For, in the Consolidation Line, every rating and type of locomotive is available with or without dynamic braking, as your needs dictate.

The "C" Line unit is provided with space into which the high capacity dynamic braking subassembly can be mounted. Assemblies are accessible and easy to install. Space and connections are designed so that installation is practical at any time—as for instance, when a locomotive is transferred to a service where dynamic braking is considered almost mandatory from one where it was not necessary. For more information, talk this over with a Fairbanks-Morse representative or write Fairbanks, Morse & Co., Chicago 5, Ill.

When it comes to locomotives . . .

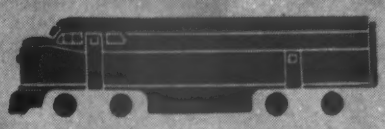


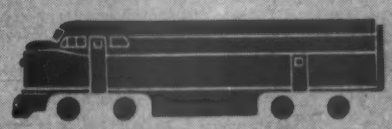
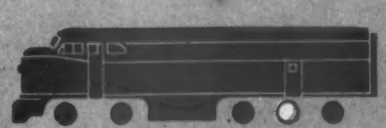
FAIRBANKS-MORSE,

a name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS
GENERATORS • STOKERS • RAILROAD MOTOR CARS and STANDPIPES
FARM EQUIPMENT • MAGNETOS

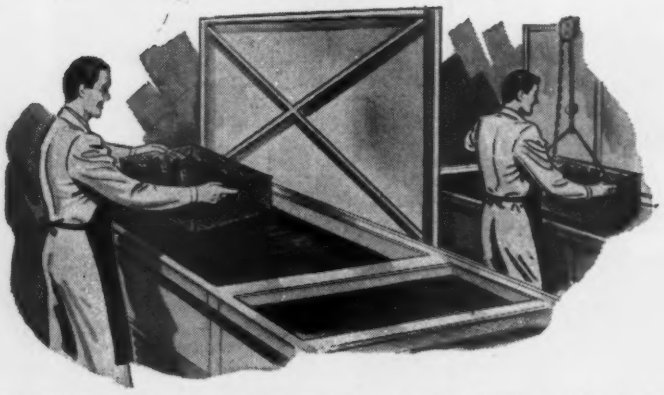
"C" LINE BASIC UNITS

HORSE-POWER	FREIGHT	DYNAMIC BRAKING AVAILABLE?
1600		Yes
2000		Yes
2400		Yes

HORSE-POWER	PASSENGER	DYNAMIC BRAKING AVAILABLE?
1600	 WATER CAPACITY—1,000 GALS.	Yes
1600	WATER CAPACITY—1,500 GALS.	Yes
2000	 WATER CAPACITY—1,500 GALS.	Yes
2400	WATER CAPACITY—1,500 GALS.	Yes

Put FLEXIBILITY into your Cleaning

and Obtain Cleaner Work and Much Lower Over-All Costs



MAGNUS AJA-DIP CLEANING MACHINES

have shown that they do a more thorough cleaning job in less time . . . with less costly labor, and on a more flexible basis than by any other methods now in use in railroad shops.

They are used, along with the Magnus Cleaners best adapted to the individual cleaning operation, on all kinds of units and parts, including:

Air Filters	Signal Elements
Compressors	Electrical Equipment
Diesel Blocks and Parts	Steam Locomotive Parts

Railroad users report savings like these: "Parts are ready for reinstallation in one-fourth the time formerly required." "70% saved in time with a 10% increase in output." "Clean in 45 minutes loads that formerly took 8 hours." "One 8-hour shift turns out miscellaneous cleaned parts that used to take 36 hours."

Nine of the big roads are depending on Magnus Aja-Dip Machines and Magnus Chemicals for many of their cleaning operations. It will pay you to write for Bulletin #407 to see what Magnus can do for you.

Magnus on Other Cleaning Jobs

There are specialized Magnus Cleaners for many other railroad operations where cleaning machines are not involved, such as:

Coach Washing, Interior and Exterior • Floor Cleaning, All Types • Freight and Refrigerator Car Cleaning • Upholstery Cleaning

These Cleaners are also worth looking into!

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd.
4040 Rue Masson, Montreal 36, Que.

MAGNUS CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

power-generating projects. He was appointed division engineer in 1930 and was named manager of engineering in 1936. He was elected vice-president in charge of engineering and research in

Bacharach

Marvin W. Smith

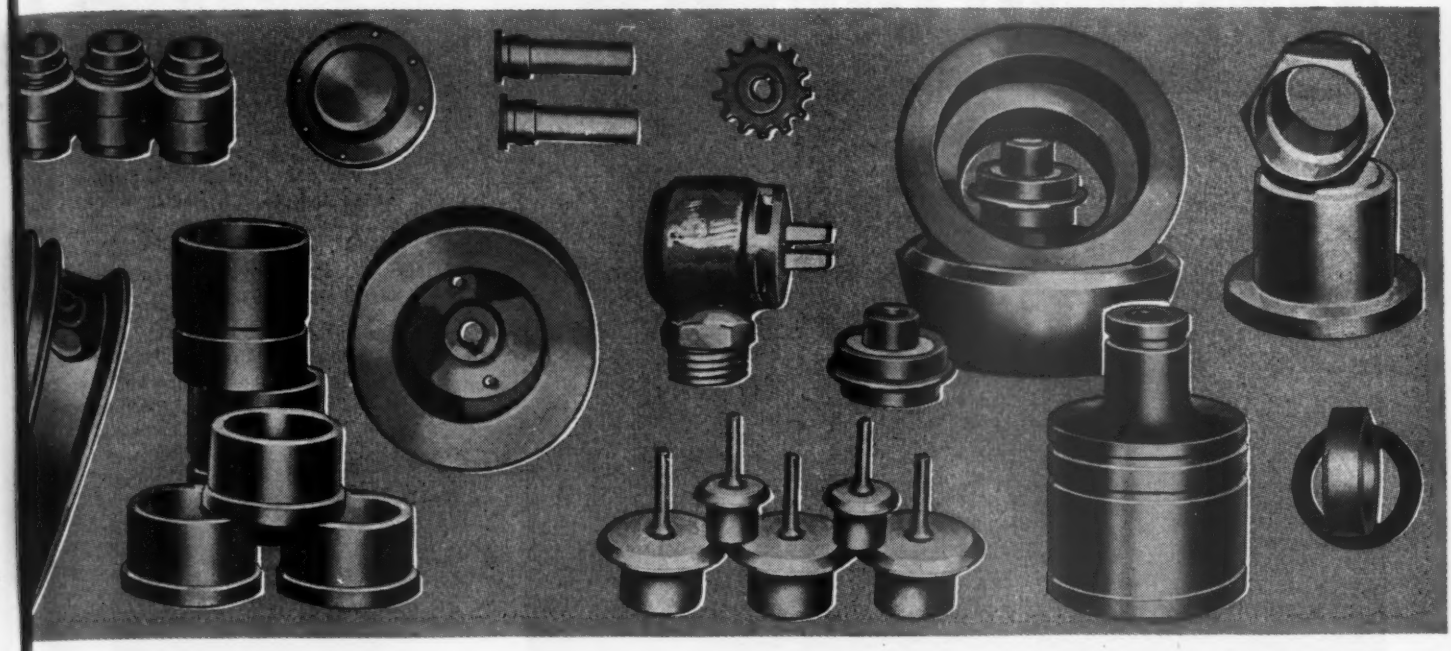
1939, and in 1938 was awarded the company's order of merit, a medal and citation for outstanding services. On July 29, 1948, Mr. Smith left Westinghouse to become executive vice-president of Baldwin.

A training school in Diesel locomotive operation that brings the locomotive into the classroom, rather than the class to the locomotive, is now being used to train steam railroad personnel by the Baldwin Locomotive Works. A 6,000-hp. Baldwin Diesel-electric road locomotive and a 1,000-hp. Baldwin switcher are brought before the class by means of life-size operating panel boards, which duplicate both the appearance and operation of panel boards in the actual locomotives. Complete sequences are run on these panels. When the "locomotive" is in operation, lights mounted on relays focus attention on the steps of the sequence as they take place. Mechanical linkage causes the governor and the fuel injection pump, both cutaway models, to function as they would on an actual locomotive. Overspeed control, fan and shutter control, emergency shut-down equipment, and pressure and temperature gauges perform in the same way. A life-size, two-cylinder cutaway model of an eight-cylinder Baldwin Diesel engine is about to be added to the panels. A supercharger cutaway is mounted on the engine and performs as in normal operation.

Classes are taught by James Barnhill and Richard Campbell, Baldwin Diesel field-service engineers. Robert M. Harrison is director of the school. The 20-hour course is limited to 20 members and to one two-hour session per day. Those attending include enginemen, firemen, hostlers, road foremen, special-duty men and any others whose training will help reduce delays in changeover from steam to Diesel operation.

Emphasis is on practical work rather than on theory. In a final examination, each member of the class must reduce faults set up on the panel. In the final session the contents of the course are given out in written form. The course

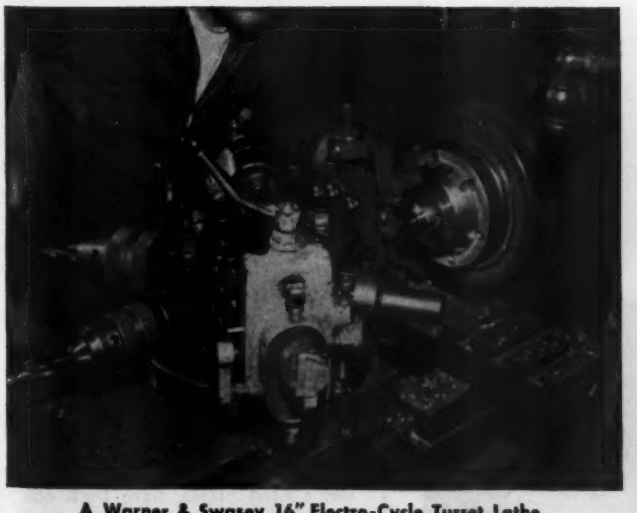
FOR LESS . . . . WITH A WARNER & SWASEY



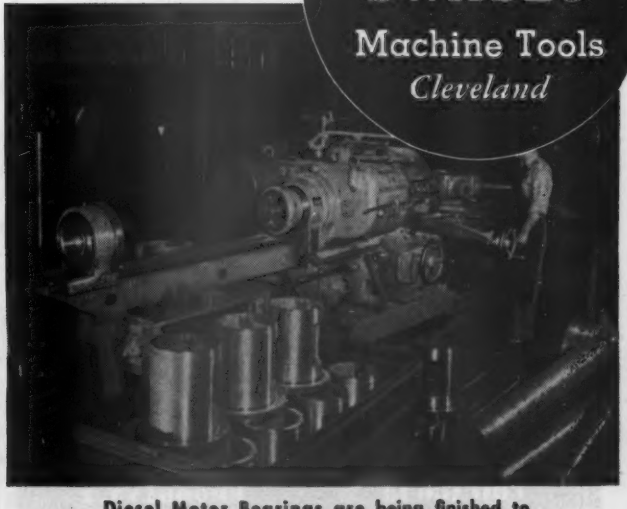
Overhauls

parts in all shapes and sizes

WARNER
&
SWASEY
Machine Tools
Cleveland

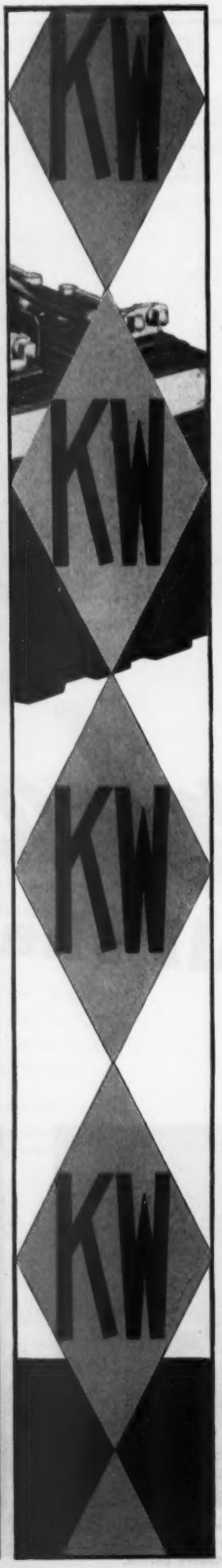


A Warner & Swasey 16" Electro-Cycle Turret Lathe in the Burlington shops is turning out brazing sleeves for ⅜" copper tubing for locomotive unions.



Diesel Motor Bearings are being finished to exact dimensions on this 3-A Warner & Swasey in the Aurora Shops of the Burlington Railroad.

Depend on



the battery that's Designed for Diesel Duty—

AND DOES THE JOB IT'S DESIGNED TO DO!

Diesel driven equipment demands...

- **A Battery that gives a large volume of current at starting motor voltage requirements . . .**
- **A Battery that maintains operating voltages at low temperature limits . . .**
- **A Battery that's built with high electrical efficiency and conducting capacity . . .**
- **A BATTERY THAT'S DESIGNED TO SATISFY THESE AND THE MANY OTHER AUXILIARY DEMANDS OF DIESEL SERVICE . . .**

K. W.! Depend on K. W. to do the job it's designed to do!

K. W. BATTERY COMPANY, Inc.

3705 N. LINCOLN AVE. CHICAGO 13 — Foot of MONTAGUE ST. BROOKLYN, 2

comprises identification of equipment; inspection before starting; starting and after starting; operation of the locomotive; routine road inspection; emergency devices, including fire fighting, and trouble shooting on operating difficulties. Films are shown on each of these six phases.

First started in early 1948, the school has held extended courses for more than 3,000 selected students in Harrisburg, Pa., Altoona and Pittsburgh, Baltimore, Md., and Grand Rapids, Mich. When it has completed its rounds, the equipment will return to the Baldwin works at Eddystone, Pa., to become a permanent Diesel training school.

◆

VAPOR HEATING CORPORATION.—*E. B. Moore* has been appointed director of research of heating controls, thermostats

E. B. Moore

and relays used by the transportation industry. Mr. Moore is a graduate in engineering of Purdue University.

L. A. Richardson and *J. E. Morris* have been appointed district managers in charge of sales and service to railroads, with headquarters, respectively, at Washington, D. C., and St. Paul, Minn.

◆

ALLEN-O'NEILL ASSOCIATES, INC.—*William J. O'Neill*, whose retirement as superintendent of motive power of the Western Pacific was reported in the May issue, has been appointed senior vice-president of the railway division of Allen-O'Neill Associates, Inc., San Francisco, Calif.

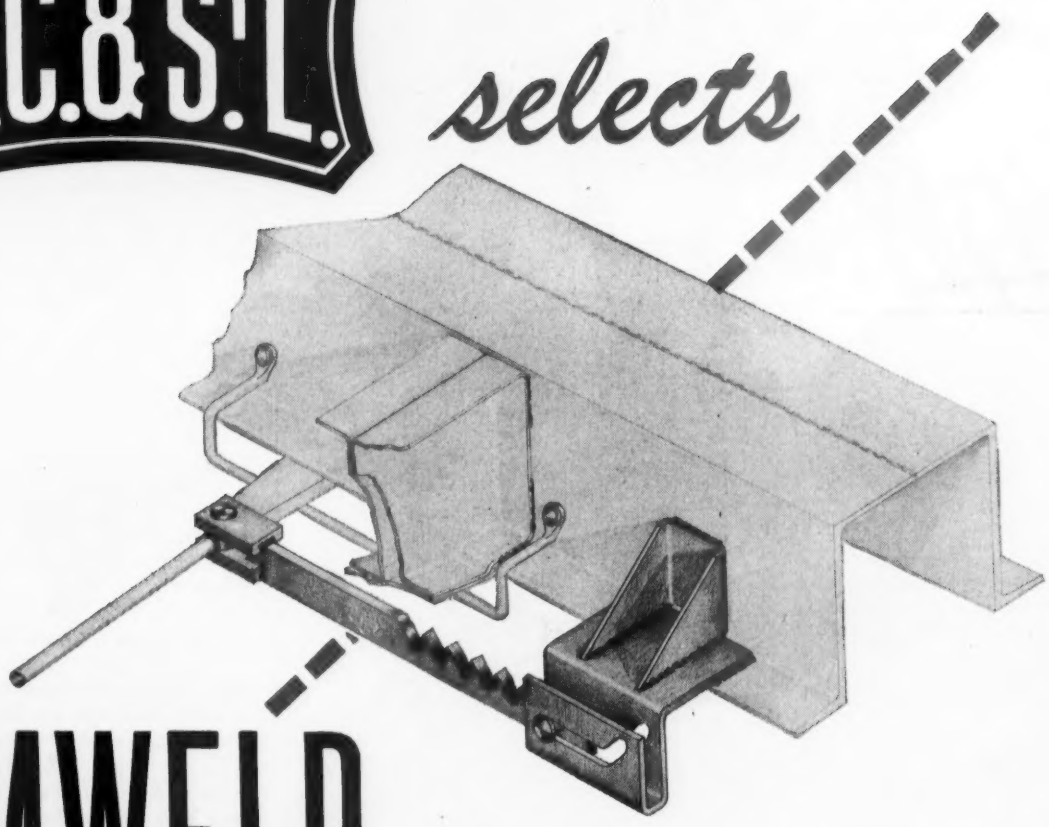
◆

HOUDAILLE-HERSHEY CORPORATION.—The Houde engineering division of the Houdaille-Hershey Corporation, Buffalo, N. Y., has opened a Chicago office at 205 W. Wacker drive (Engineers building).

◆

NELSON STUD WELDING DIVISION, MORTON GREGORY CORPORATION. Arrangements for the sale of patented Nelson stud welding guns, gun parts, patented ferrules, and patented flux-filled studs to *K S M Products Corporation*, of Merchantville, N. J., for resale by them in the United States, have been completed by the Nelson Stud Welding Division of Morton Gregory Corporation, which has

N.C.&St.L. selects



AMWELD BRAKE SLACK ADJUSTERS

AMWELD Slack Adjusters are in operation on these railroads:

Chesapeake and Ohio R.R.
Cudahy Car Lines
Erie Railroad Co.
Ford Motor Company
General American Trans. Corp.
Mather Stock Car Co.
New York, New Haven & Hartford R.R.
Norfolk and Western R.R.
North American Car Corp.
Union Railway Co.
Virginian Railway
Wheeling and Lake Erie R.R.
Baltimore & Ohio R.R.
Delaware and Hudson R.R.
Interstate Railroad Co.
Southern Railway System
General Chemical Division (Allied Chemical & Dye Corp.)
Cities Service Oil Co.
Western Maryland R.R.
Delcware, Lackawanna & Western R.R.
Chicago, Rock Island and Pacific R.R.

. . . and orders have been received from:

Central Railroad Co. of N.J.
Duluth, South Shore & Atlantic R.R.
Escanaba & Lake Superior R.R.
Nashville, Chattanooga & St. Louis R.R.
St. Louis-San Francisco R.R.
Shippers' Car Line Corp.
Mexican Petroleum Corp.

The Nashville, Chattanooga and St. Louis Railway is applying 1,000 AMWELD Brake Slack Adjusters, Type "B-2" to 500 hopper cars and 500 gondolas being built by the Pullman Standard Car Mfg. Company.

This order is another example of the growing acceptance of AMWELD Brake Slack Adjusters.

AMWELD Brake Slack Adjusters are in operation on many railroads, some of which are listed. Three models, "T", "B", and "C" . . . AMWELDS are adaptable and easily installed on most types of freight cars.

Your request for information regarding AMWELD Brake Slack Adjusters will bring complete data including typical application prints. A representative will be glad to call if you say the word!

AMWELD RAILWAY EQUIPMENT

Division of

THE AMERICAN WELDING & MANUFACTURING COMPANY

260 DIETZ ROAD • WARREN, OHIO

Fig. 2140
GLOBE
125 lb. S.P.
200 lb. W.O.G.

125 lb. S. P. BRONZE GLOBE, ANGLE and CHECK VALVES
Built to **LUNKENHEIMER**
QUALITY STANDARDS

Circular No. 582 gives complete details on these new Valves. Mailed upon request.

Want a lower pressure valve to give the same dependable, low-cost service you get in higher pressure LUNKENHEIMER Valves?

Here it is — New Fig. 2140 Globe; Fig. 2141 Angle; Fig. 2142 Lift Check; Fig. 2144 Swing Check. These valves feature Lunkenheimer's traditionally fine design and sturdy construction, plus exclusive silicon bronze alloy stems which eliminate stem thread failure due to wear.

Whatever your requirements for lower pressure service, you'll find these new valves unequalled for dependability and true economy.

Fig. 2142 LIFT CHECK
125 lb. S.P. 200 lb. W.O.G.

Nowhere in the line is dependability more important than in Check Valves. These Checks function quickly and positively, seat accurately and tightly.

Fig. 2144 SWING CHECK
125 lb. S.P. 200 lb. W.O.G.

LUNKENHEIMER manufactures a wide variety of products for railroad service requirements . . . Valves of bronze, iron and steel; cocks, fittings, unions, air nozzles, boiler mountings and lubricating devices. Write for Circular No. 521, "LUNKENHEIMER VALVES for Railroad Service".

ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO, U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34
EXPORT DEPT 318-322 HUDSON ST. NEW YORK 13, N. Y.

also licensed K S M to manufacture and sell slug-loaded studs in this country. K S M is not licensed, however, to make flux-filled studs, but can purchase them from the Nelson Stud Welding Division for resale.

◆

OXWELD RAILROAD SERVICE COMPANY.—*James W. Ritcey*, mechanical superintendent, Pennsylvania district, Oxweld Railroad Service Company (unit of Union Carbide & Carbon Corp.), has been appointed sales representative of the firm's New York sales office. Mr. Ritcey has been succeeded by *H. V. Dorminey*.

◆

THOMAS C. WILSON, INC.—The tube expander business of *Richard Dudgeon, Inc.*, New York, has been purchased by Thomas C. Wilson, Inc., Long Island City, N. Y.

◆

SUPERIOR RAILWAY PRODUCTS CORPORATION.—The Superior Railway Products Corporation, Pittsburgh, Pa., has moved its offices to 512 Franklin avenue, Pittsburgh 21.

◆

PARR PAINT & COLOR CO.—*C. D. Hicks & Co.*, Clayton (St. Louis), Mo., have been appointed railroad sales representatives in St. Louis for the Parr Paint & Color Co., Cleveland, Ohio.

◆

IRON & STEEL PRODUCTS, INC.—The New York office of Iron & Steel Products, Inc., has been moved from 120 Liberty street to 50 Church street.

◆

ELECTRO-MOTIVE DIVISION, GENERAL MOTORS CORPORATION.—*W. N. Fritts*, manager, sales engineering section, has been appointed assistant general sales manager. *Marvin Anderson*, manager, parts distribution, has been appointed assistant general parts manager. *W. D. Davis*, general repair manager, has been assigned to coordinate and expedite new branch shop construction. *M. H. Gardner*, district sales manager at St. Louis, Mo., has been appointed general repair manager at LaGrange, Ill., and *C. R. Wood*, branch manager, Jacksonville (Fla.) shop, has been appointed assistant general repair manager at LaGrange.

◆

MORRIS B. BREWSTER; T-Z RAILWAY EQUIPMENT COMPANY.—*William H. White* has been elected vice-president of the *Morris B. Brewster Company*, and the *T-Z Railway Equipment Company*, Chicago, with headquarters at Roanoke, Va.

Mr. White has been associated with the two firms continuously since 1934, engaged in the redesigning of sander equipment and in the servicing of all equipment. He was born at Salem, Va., on May 10, 1879, and began his career as a helper in the Norfolk & Western shops in Bluefield, W. Va., in 1902. In the following year he was transferred to the shops at West Roanoke, Va. In 1906, he became pipe fitter mechanic. He organized the Graham-White Sander Corporation in 1914, and returned to the West Roanoke shops in 1918. He subsequently

MINER
CLASS A-121-X
FRICTION DRAFT GEAR

for
DIESEL
LOCOMOTIVES

W. H. MINER INC. - CHICAGO

"'Tain't fair—he's standing on slip-resistant 4-WAY Safety Plate!"

Yes, Inland 4-WAY Safety Plate provides superior slip-resistance—built-in *safety*. Install it wherever feet or wheels must go—on floors, steps, platforms—in your plant or on your product. Made of steel, it lasts for years. INLAND STEEL CO., 38 South Dearborn Street, Chicago 3, Illinois.

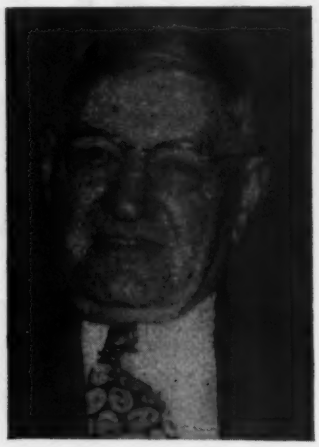
WRITE FOR BOOKLET

Inland 4-WAY* SAFETY PLATE

STOCKED BY LEADING STEEL WAREHOUSES

*Reg. U. S. Pat. Off.

became inspector of new locomotives and, during World War I, was employed in the inspection and test section of the United States Railroad Administration.



William H. White

Mr. White later returned to the N. & W. West Roanoke shops, and in 1924 to the Graham-White Sander Corporation. He remained with Graham-White until he became associated with the Morris B. Brewster and T-Z Railway Equipment Companies in 1934.

◆

WESTINGHOUSE AIR BRAKE COMPANY. —*A. M. Wiggins* has been elected vice-president of the *Westinghouse Air Brake Company*.

Mr. Wiggins is a graduate of Purdue University in electrical engineering. He attended also the Cleveland Law School, and in 1933 joined Westinghouse Air

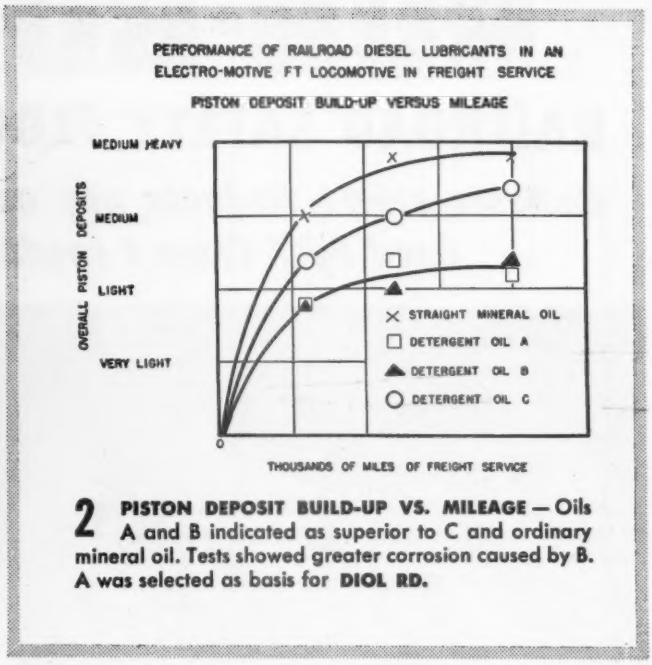
A. M. Wiggins

Brake as a patent attorney. In 1938, he was placed in charge of the legal department; in April, 1945, elected an assistant vice-president in charge of patent and legal matters, and in 1946, appointed executive assistant to the president.

◆

OKONITE COMPANY.—The Okonite Company, Passaic, N. J., has elected the following three new vice-presidents: *I. W. Bordo*, manager of the Pacific Coast district; *W. R. Van Steenburgh*, manager of the North-East sales district; and *Stephen*

1 **EARL W. BALL,** Esso sales dept. lubrication engineer, watches **DR. LEONARD E. MOODY,** Standard Oil Development Co. research chemist, rate piston and rings for carbon and varnish deposits.



2 **PISTON DEPOSIT BUILD-UP VS. MILEAGE** — Oils A and B indicated as superior to C and ordinary mineral oil. Tests showed greater corrosion caused by B. A was selected as basis for **DIOL RD.**

Diol RD...Great New Diesel Locomotive Lubricating Oil Developed in Largest Controlled Lubricant Field Test Ever Conducted!

A THREE-YEAR TEST—the most comprehensive ever conducted on diesel locomotive lubricating oils—has been completed by Esso.

ESSO'S LABORATORY ON WHEELS was a two-unit Electro-Motive locomotive equipped with V-type, 1,350 hp., 800 r.p.m., 16 cylinder, 8½ x 10 in. diesel engines. A complete set of testing instruments, including specially devised equipment, was installed and the locomotive was put into service on the N. Y., O. and W.

AT THE END OF THE TEST locomotive #601 had gone over a half million miles under varying conditions of load, speed and temperatures. A vast amount of important information and "know-how" on diesel operation had been accumulated . . . and a superior new lubricating oil had been developed. The oil, now named **DIOL RD,** is available in two grades: **74** and **76. DIOL RD** contains a special additive that *reduces engine deposits, inhibits corrosion, fights oxidation, is not lost in service.*

FOR FURTHER INFORMATION on DIOL RD 74 and 76 and this unprecedented 3-year test, contact Esso Railroad Sales Division, Esso Standard Oil Co., 15 West 51st St., New York 19, N. Y., today!

3 **N. Y., ONTARIO & WESTERN LOCOMOTIVE #601** as it was being equipped with testing instruments for Esso's 3-year, half-million mile controlled field test of diesel lubricants.

The Sign of QUALITY

Esso

The Symbol of SERVICE

RAILROAD PRODUCTS

SOLD IN Maine, N. H., Vt., Mass., Conn., R. I., N. Y., Penna., N. J., Del., Md., D. C., Va., W. Va., N. C., S. C., Tenn., Ark., La.

ESSO STANDARD OIL COMPANY—Boston, Mass.—New York, N. Y.—Elizabeth, N. J.—Baltimore, Md.—Richmond, Va.—Charleston, W. Va.—Charlotte, N. C.—Columbia, S. C.—Memphis, Tenn.—Little Rock, Ark.—New Orleans, La.

ESSO STANDARD OIL COMPANY OF PENNSYLVANIA—Philadelphia, Pa.

RUB-BUB*

RAILROAD SAFETY FLOORING

Outlasts steel! Reduces pay accidents!
Used by 7 Class 1 roads!

RUB-BUB Heavy-Duty Safety Vestibule Plate consists of a dense *5/16 inch thickness* of RUB-BUB compound double-bonded to expanded-metal backing to prevent excessive "growth". Microphotograph shows compact, fibrous texture of RUB-BUB synthetic compound. It's tough . . . sinewy . . . non-skid *wet or dry.* Its longer-wearing surface *cuts maintenance costs.*

DO you want a flooring that will be as safe *after years of service* as it was the day you installed it? Investigate RUB-BUB Heavy-Duty Safety Vestibule Plate today!

You get years of extra flooring life because tough RUB-BUB synthetic rubber compound is thicker and abrasive dirt collects in deep grooves below contact surfaces. You reduce pay accidents because exclusive Dri-Foot tread design drains water off faster . . . grips passenger shoes tighter.

Don't take a chance. *Maintenance records of 7 major Class 1 railroads in the United States and Canada show that RUB-BUB safety products last longer, stay safe longer.*

For a matched installation also specify RUB-BUB Heavy-Duty Safety Step Plate. It has the same longer-lasting tread plus a resilient, live-rubber lip that resists chopping action of heels . . . *eliminates shattered shinbone accidents.*

Write for samples today. See for yourself why RUB-BUB Vestibule Plate and Step Plate remain *safer—years longer!* Specify RUB-BUB safety flooring for vestibules, aisles and steps in all your new and reconditioned cars.

RUB-BUB
Transportation Products

SAMUEL MOORE & CO. MANTUA, OHIO

IN CANADA | RAILWAY & POWER ENG. CORP.
Montreal • Hamilton • Windsor
Toronto • North Bay • Winnipeg
Vancouver • Noranda • New Glasgow

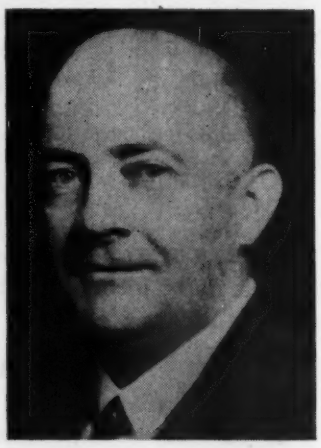
A. Wilson, secretary and general counsel. Messrs. Bordo, Van Steenburgh and Wilson continue also in their previous capacities.

Okonite has a new office in Dallas, Tex., at 1505 Tower Petroleum building, to be under the supervision of the Birmingham, Ala., district. *Otis W. Herring*, formerly in the Birmingham office, has been appointed manager of the new office and will be assisted by *S. K. Dick*, sales engineer.

◆

PYLE-NATIONAL COMPANY.—*Thomas J. Little*, eastern sales manager of the *Pyle-National Company*, New York, has been elected vice-president in charge of the Eastern division at New York, succeeding *A. N. Martin*, whose retirement was reported in the May issue.

Mr. Little spent the first five years of his business career with the Anaconda Copper Mining Company and the next four years in the study of electrical engineering at Union College, and the General Electric engineering test departments at Schenectady, N. Y., and Pittsfield, Mass., where he specialized in railway electrification and high-voltage work.



Thomas J. Little

After completion of this training he returned to Anaconda and for five years was electrical engineer and electrical superintendent of the firm's Anaconda (Mont.) and Butte properties. In 1925 he became a member of the sales organization of the Anaconda Wire & Cable Co., New York, and subsequently served as sales engineer, manager of transmission sales, and executive assistant. In February, 1948, he was appointed eastern sales manager of Pyle-National.

◆

YOUNGSTOWN SHEET & TUBE CO.—*L. E. Wallace*, formerly manager of the New York sales office, has been appointed general manager of sales of the Youngstown Sheet & Tube Co., at Youngstown, Ohio, and *J. W. Owings*, formerly manager of oil country tubular sales, has been appointed assistant general manager of sales. *M. H. Watkins*, who has been assistant general manager of sales for nearly two years, will continue to assist Mr. Wallace. *John P. Feagley*, formerly assistant district sales manager at New York, has been appointed New York dis-

YOU can't beat Barber Stabilized Trucks for easy riding. These trucks are now available with A.A.R. type frames and bolsters for all spring deflections. Fine *lateral* as well as *vertical* control is obtained with trucks having spring deflections up to $3\frac{13}{16}$".

Over 210,000 sets of Barber Stabilized Trucks have been ordered, of which more than 90.000 are the Spring Plankless Type.

Easy GOING!

Barber Variable Friction Stabilized Trucks

1 Special Alloy-Iron friction casting having 35 square inches of friction-bearing surface.
2 Spring-steel wear plate securely bolted or welded to the column.
3 Friction-casting-supporting side-spring having a minimum 3/4" initial compression.

BARBER FEATURES:

☆ *Easy Riding* ☆ *Minimum Number of Parts*

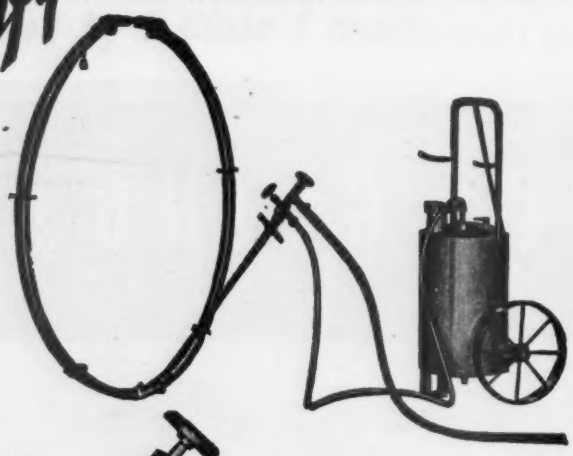
☆ *Long Wearing* ☆ *Easy to Assemble* ☆ *Easy to Dismantle*

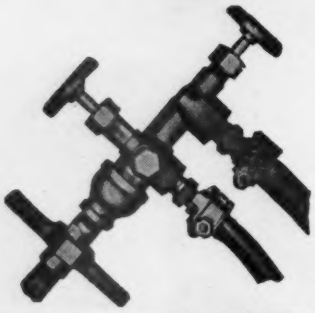
3244

STANDARD CAR TRUCK COMPANY

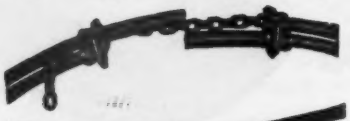
332 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

Specify JOHNSTON





Valve Body with quick Detachable Union



TOP OF RING

BOTTOM OF RING

VACUUM TYPE Locomotive
TIRE HEATER

SAFE VACUUM Principle — eliminates danger of tank explosion, bursting hose, and oil hose pulling off from connections.

UNIFORM HEAT — No hot spots — Fire starts quickly without smoke or oil drip as nothing but finely atomized fuel can be fed to the ring. The air that lifts the oil also atomizes it.

This heater is quiet, fast, efficient and SAFE in operation. Operates on compressed air (40-125 lbs.) and kerosene or 38-40° B^2 distillate.

Write for Bulletin R-811.

THE JOHNSTON LINE — SAFETY DEPENDABILITY

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE.
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

trict sales manager, succeeding Mr. Wallace, and *Philip G. Boyd*, formerly assistant district sales manager at Chicago, has been appointed Chicago district sales manager, succeeding the late *Arthur Purnell*.

◆

AMERICAN BRAKE SHOE COMPANY.—*James R. Shepard* has been appointed western district works manager of the brake shoe and castings division of the American Brake Shoe Company, with headquarters at Chicago, and *Thomas J. Wood* has been appointed eastern district works manager, with headquarters at New York.

Mr. Shepard attended Yale University and joined Brake Shoe in 1937 as an

James R. Shepard

apprentice. He was Eastern district works manager at New York at the time of his recent appointment.

Mr. Wood is a graduate of Lehigh University. He joined the company in 1939.

Thomas J. Wood

Before his appointment as eastern district works manager he was superintendent of the division's Mahwah (N. J.) plant.

◆

ARO EQUIPMENT CORPORATION.—*Aro Sales & Service, Inc.*, has been appointed distributor for Aro products in the States of California, Washington, and Oregon. Headquarters will be maintained at 2023 South Grand avenue, Los Angeles

BULLARD *Universal*

BORING MACHINES INSURE PRODUCTIVE CAPACITY . . . with *Maintained Accuracy*

Made in 3-inch, 4-inch and 5-inch spindle sizes

Accuracy of your boring, drilling and milling operations is assured with Bullard-Universal Boring Machines.

These well designed and rigidly built machines have a well known Productive Capacity with maintained Accuracy.

GOOD REASONS WHY

Convenient right hand centralized controls speed up operation. Rapid Traverse to all units in all directions eliminates much lost time between operations.

Ease of operation and control minimizes operator fatigue.

Hydrodynamic coupling provides unsurpassed smoothness of Power flow for all operations. (Greater tool efficiency).

AND FOR THE MAINTAINED ACCURACY

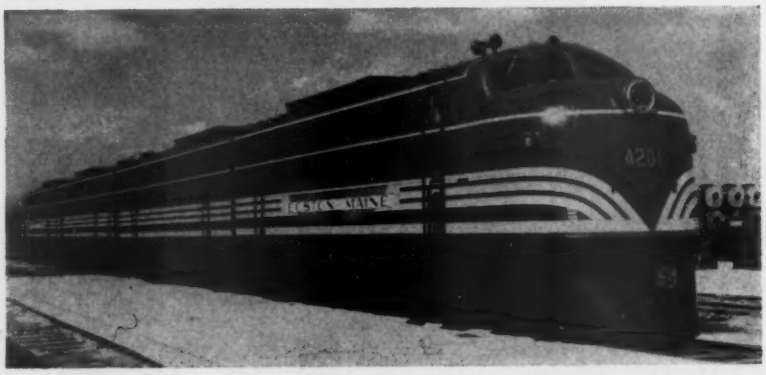
1. Heavy well ribbed box type Bed construction absorbs vibration and torsional strains.
2. Sturdy, heavily ribbed Posts assure maximum rigidity.
3. Extra heavy gibs with gib within gib construction having adjustment of the wear shoe.
4. Table and Saddle unit construction offers continued precision alignment.
5. Precision types of Anti-friction bearings minimize horsepower requirements and assure sustained accuracy.

1. **Stability**
2. **Productivity**
3. **Maintained Accuracy**
4. **Centralized right hand control**
5. **One shot lubrication for head, saddle and table assembly**
6. **Anti-friction bearings**
7. **3-inch, 4-inch and 5-inch Spindles with selection of Bed lengths, Column heights and Table sizes**

THE BULLARD COMPANY

BULLARD

BRIDGEPORT 2, CONN.



Why Cleaning Operations on Diesels are better handled with PERMAG

PERMAG CAR CLEANER

- Removes Diesel oil film, road dirt, grime from stainless steel and painted coaches.

- PERMAG Compounds are formulated from powerful and effective cleaning ingredients.
- In action: PERMAG is fast, vigorous and rinses thoroughly, leaving a clean greaseless surface.
- PERMAG works economically—cleaning engine parts in minimum time, reducing high costs of labor and material.

Mechanical and Car Supervisors are invited to write us for details on PERMAG for railroad service.

MAGNUSON PRODUCTS CORP.
Main Office: 50 COURT STREET, BROOKLYN 2, N. Y.
In CANADA: Canadian PERMAG Products, Ltd., Montreal, Que.

PERMAG Cleaning Compounds

New Efficiency and Savings in Your Yard with ROUSTABOUT CRANES

The fast tractor-footed load hustlers

● Wide open yard spaces that eat up profits start paying off with Roustabout Cranes on the job, loading, unloading, moving, shifting, stacking. Grab-bucket, hook or magnet, *where* you want them, *when* you want them. Engineered for years of overwork—mounted on wheel or crawler tractors. Loads to 7½ tons. Roustabout saves costly delays and manpower . . . pays for itself fast. Write for the money-saving facts today—to Dept. G-3.

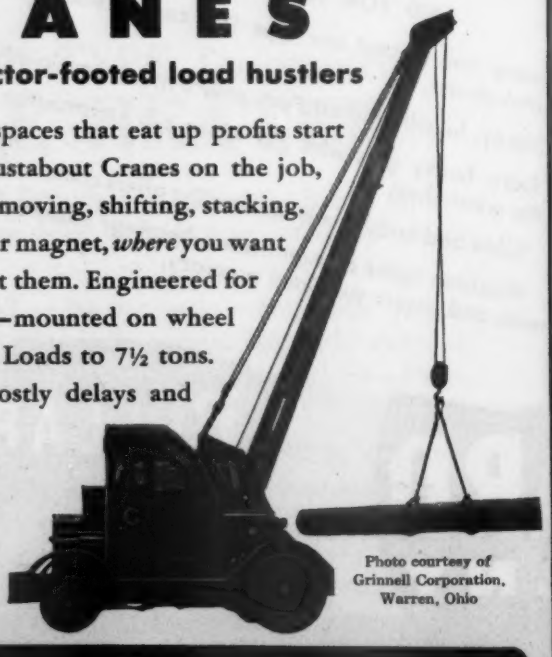


Photo courtesy of Grinnell Corporation, Warren, Ohio

ROUSTABOUT CRANE

HUGHES-KEENAN CORPORATION
DELAWARE · OHIO · U. S. A.
Load-Handling Specialists since 1904

7, Calif. The office in San Francisco, Calif., is located at 766 Brannan street. Sales and service for the Pacific Northwest will be handled by the Pratto Sales Company, 714 Fourth avenue, Seattle, Wash.

◆

ALAN WOOD STEEL COMPANY.—*Perry L. Francis*, formerly general manager of sales of the *Alan Wood Steel Company*, has been elected vice-president in charge of sales.

Mr. Francis joined the Alan Wood sales organization in 1924 and has served the company in San Francisco, Calif.,

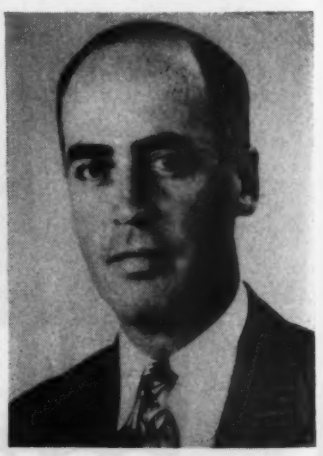
Perry L. Francis

Los Angeles, and Seattle, Wash. On February 5, 1947, he was appointed general manager of sales at the company's home office in Conshohocken, Pa.

◆

SPICER MANUFACTURING DIVISION, DANA CORPORATION.—*D. D. Robertson*, assistant sales manager of the Spicer Manufacturing division of the Dana Corporation, Toledo, Ohio, has been appointed sales manager, and *Willis L. Stone*, of the sales department, has been appointed assistant sales manager.

Mr. Robertson is a graduate in mechanical engineering from the Georgia



D. D. Robertson

School of Technology. After graduation he joined the Bethlehem Steel Company. He later was chief engineer of the Wilkening Manufacturing Company, Philadelphia, Pa., and also was in charge of

Eliminate dead weight

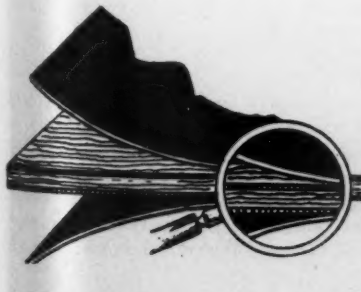
Promote ease of operation

use

MET-L-WOOD
METAL BONDED TO PLYWOOD
baggage car doors

Give added durability . . . for new and modernized cars. . . . Standard designs available or furnished to your designs and specifications.

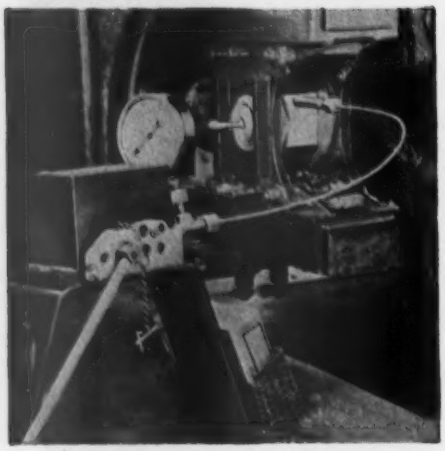
Consider MET-L-WOOD when you order new cars or plan a modernization program. Our engineering staff will gladly help you to make the most advantageous use of MET-L-WOOD products.



MET-L-WOOD CORPORATION

6755 West 65th Street, Chicago 38, Illinois

Keep Your SPERRY HYDRAULIC PISTON ROD PARTER Operating at Maximum Efficiency



All Parts Now Available

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- Separates piston rod from cross head quickly.
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- Easy to set up and operate—no wedges, no loose filler blocks.
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all original equipment sales to automobile and industrial manufacturers. Mr. Robertson joined Spicer in 1937 as sales engineer and was appointed assistant sales manager in 1943.

Mr. Stone, a graduate of Syracuse University, joined the Brown-Lipe Gear Company, Syracuse, N. Y., in 1945. He went to Toledo, Ohio, when the Brown-Lipe facilities were merged with those of Spicer.

Willis L. Stone

◆

WYANDOTTE CHEMICALS CORPORATION. —*J. Hickson* has been appointed sales promotion manager of the J. B. Ford Division of the Wyandotte Chemicals Corporation.

Obituary

FRANK B. BELL, founder and chairman of the board of the Edgewater Steel Company, died on May 6, after an illness of several weeks. Mr. Bell was born in Mercer, Pa., on September 24, 1876. He obtained a degree in mechanical engineering from Lehigh University in 1897 and received a doctor of engineering degree from Lehigh in 1944. Mr. Bell was appointed assistant openhearth superintendent for the Clairton Steel Company after several years' experience in the steel industry with various Pittsburgh, Pa., firms. In 1905 he was appointed assistant superintendent of the Latrobe Steel & Coupler Co., Melrose Park, Ill. He left that company in 1908 to build the Inter Ocean Steel Company plant at Chicago Heights, Ill., which later became part of the Railway Steel Spring Company, now a subsidiary of the American Locomotive Company. In 1916, Mr. Bell returned to Pittsburgh and organized the Edgewater Steel Company, to produce railroad wheels, tires, and rings with a mill he designed that utilized a new rolling principle.

Frank B. Bell

◆

CARL H. WILL, president of Tropic-Aire, Inc., Chicago, died in that city on March 26.

PERSONAL MENTION

General

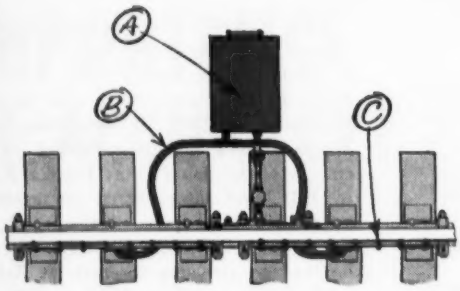
A. R. SNYDER, whose appointment as assistant general superintendent of motive power and machinery of the Union Pacific at Salt Lake City, Utah, was reported in the May issue, was born at North Platte, Neb., on August 24, 1906. He entered U. P. service in June, 1920, as a carman apprentice, and subsequently served in several mechanical positions until January, 1941, when he became master mechanic at Council Bluffs, Iowa. He was transferred to Cheyenne, Wyo., a year later, and returned to his former post at Council Bluffs in November, 1943.

A. R. Snyder

The next year he was again transferred to the Wyoming division as master mechanic, becoming superintendent of motive power and machinery at Omaha, Neb., in November, 1945, and mechanical superintendent of Diesel power at Omaha, in July, 1947.

D. S. NEUHART, whose appointment as general superintendent of motive power and machinery for the Union Pacific at Omaha, Neb., was reported in the May issue, was born on September 19, 1901, at Salt Lake City, Utah, where he entered railroad service in June, 1918, as a coach cleaner. During off hours he took

Case 1141—Reducing Wear on Rails at Curves



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Car and engine wheels carried Calol Rail and Flange Lubricant and lubricated rails for a distance of more than two miles from an automatic lubricator. Calol Rail and Flange Lubricant is made from a highly water-resistant base and special lubricating graphite.

A. Very stable in use and storage — will not separate in any climate along U.S. railroads . . . will not wash off rails or flanges.

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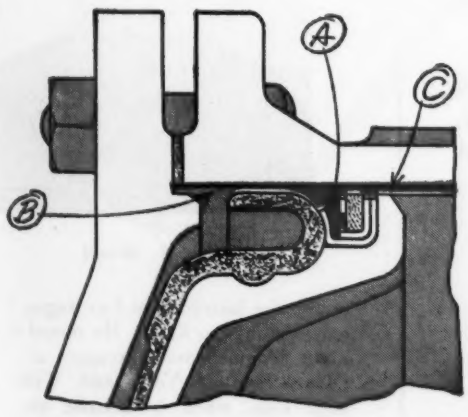
C. Forms and retains "button" formation on wiping bar.

Calol Rail and Flange Lubricant has a "short" non-stringy texture. This keeps it on flanges and the sides of rails and minimizes the usual tendency of grease to pull over the tops of rails.

Case 1157—Maintaining Good Air-Brake Lubrication



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Equaling or exceeding all specifications of the A.A.R., Calol Brake Cylinder Lubricant provided good lubrication in both freight and passenger brake cylinders for periods exceeding the usual three years. Recommended for the older K-type brake as well as the AB freight brake and HSC passenger brake.

A. Resists deterioration or separation — small quantity maintains complete coverage of cylinder . . . keeps lubricator swab saturated and pliable.

B. Minimizes swelling or deterioration of packing cup and helps to form tight seal.

C. Provides tough lubrication film that will not ball or roll from cylinder walls.

Calol Brake Cylinder Lubricant contains more than 82% highly refined and specially selected mineral oil, and complies with A.A.R. Specifications M-914-42.

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courses in engineering and also studied mechanical engineering at the University of Utah for 1½ years. He became shop inspector at Omaha in 1935. Later the same year he was appointed general foreman at Cheyenne, Wyo., and in 1937, assistant master mechanic. He was transferred later that year to Los Angeles, Calif., as superintendent of shops. From 1941 to 1942, he served as master mechanic at Kansas City, Mo., and as assistant to vice-president of research and mechanical standards at Omaha. He was subsequently appointed master mechanic at Los Angeles, and later in 1942 became superintendent of motive power and machinery, Eastern district, at Omaha. He was appointed assistant general superintendent of motive power and machinery at Omaha in February, 1945.

D. S. Neuhart

E. L. BACHMAN, general superintendent, motive power of the New York Zone of the Pennsylvania, at New York, has been granted a leave of absence.

Diesel

PAUL F. GIESKING, master mechanic of the Grand Junction division of the Denver & Rio Grande Western, has been appointed superintendent of Diesel equipment at Denver, Colo.

WALTER L. HUEBNER, day enginehouse foreman of the Atchison, Topeka & Santa Fe at Barstow, Calif., has been appointed supervisor of Diesel engines at Chicago. It was incorrectly stated in the May issue that Mr. Huebner had been appointed master mechanic at Clovis, N. M.

JAMES H. WHIPPLE, JR., superintendent of Diesel equipment of the Denver & Rio Grande Western at Denver, Colo., has been transferred to Burnham, Colo., as assistant superintendent of Diesel equipment.

Electrical

H. C. GRIFFITH, assistant chief engineer traction—communications—signals, of the Pennsylvania system, has been appointed chief electrical engineer, with headquarters as before at Philadelphia, Pa.

Master Mechanics And Road Foremen

J. P. FRANCIS, who has been appointed master mechanic of the Pennsylvania at Renovo, Pa., as announced in the May issue, was born on November 25, 1909, at Trenton, N. J. He attended Pennsylvania State College where he received the degree of B.S. in electrical engineering in 1932. He became a special apprentice in the employ of the Pennsylvania in 1931. In 1936 he transferred to the power plant of the Pennsylvania in Long Island City, N. Y.; in 1939 to Columbus, Ohio, St. Clair street enginehouse; in 1941 to Sharon, Ohio, as foreman; in 1942 to Delmar, Del., as foreman, and in 1943 to Conway, Pa., as assistant master mechanic.

EARL B. WOOD, who has been appointed master mechanic of the Atchison, Topeka & Santa Fe at Dodge City, Kans., as noted in the April issue, was born on September 4, 1899, at Argentine, Kans. He became a machinist helper in the employ of the Santa Fe at Topeka, Kans., in 1916, and later served as machinist apprentice at Topeka, Kans., and San Bernardino, Calif., respectively. In 1922 he became air gang foreman at Bakersfield, Calif., and from 1923 to 1930 was apprentice instructor at Las Vegas, N. M., and Wellington, Kans. He served also as night enginehouse foreman at Altus, Okla.; Slanton, Tex., and Wellington, until 1938, when he became air brake and steam heat instructor, with headquarters at Topeka. In 1943 he was appointed mechanical inspector, Coast Line, with headquarters at Los Angeles, Calif.; in 1946, general enginehouse foreman at San Bernardino, and on February 15 of the current year, master mechanic at Dodge City.

Earl B. Wood

J. W. SPRAKER, traveling A. A. R. inspector, Illinois Central and for several years chairman of A. A. R. Rules Committee of the Car Foremen's Association of Chicago, died of a heart ailment at his home in Chicago, May 5.

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The efficient method of drying sand — producing more than 2 tons of dry sand per hour at low fuel cost.

Oil or gas fired—8'0" long and 3'3" wide—weight 3000 lbs. Friction drive—mounted on sealed roller bearings.

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